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1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication October 24, 1985
1985

PLANT SPECIES BIOMASS ESTIMATES FOR 13 UPLAND COMMUNITY TYPES OF NORTHEASTERN MINNESOTA

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A series of interrelated studies designed to classify, describe, and elucidate the dynamics of upland plant community types found in northeastern Minnesota has resulted in a unique phytosociological data base. The data base contains detailed information by species and vegetative strata for 13 community types—12 forest and one nonforest. The concurrent development of biomass-estimation equations for most of the species represented in the data set allowed conversion of these phytosociologic data into estimates of biomass for various stages of community development ranging from 1 year following disturbance to maturity.

THE DATA BASE

Field

The data base represented in the accompanying tables is the result of phytosociologic and biomass data collected within or near the Boundary Waters Canoe Area Wilderness (BWCAW) as part of studies of: (1) mature upland forest and rock outcrop stands that regenerated naturally following disturbance, usually wildfire (Ohmann and Ream 1971a); (2) mature upland forest stands that regenerated naturally following logging of red and white pine, usually followed by slash fires, during the 1890 to 1930 era (Grigal and Ohmann 1975); (3) 33-year-old upland forest stands regenerated naturally following summer-season wildfires in 1936 (Ohmann *et al.* 1973); (4) 1- to 30-year-old upland forest stands regenerated by planting following logging of jack pine and black spruce (Ohmann 1982, 1984); (5) 1- to 5-year-old upland forest stands that regenerated naturally following a 1971 spring-season fire (Ohmann and Grigal 1979); and (6) 1-year-old forest stands that regenerated naturally following a 1974 summer-season wildfire (Ohmann and Grigal 1981) (table 1).[1]

The sampling design for studies 1 through 4 has been reported in detail (Ohmann and Ream 1971b). Briefly, we randomly located stands by using a grid overlay on standard topographic maps. Only upland plant communities—defined as those on which surface water never accumulates—were sampled. The minimum size of a sample area was about 5 acres (2 ha) in communities with trees and about 1/40 acre (100 m^2) in communities without trees (i.e., bedrock outcrops). Only uniform sites, with no apparent discontinuities in either vegetation or topography, were selected. We used 20 points within each stand to sample the vegetation. The point-centered quarter method (Cottam and Curtis 1956) was used for trees; circular milacre plots (4 m^2) were used for tree seedlings (<1.0 in. (2.5 cm) d.b.h.) and tall shrubs; and 1 × 2-ft (0.2-m^2) rectangular plots were used for other vegetation. The sample design and vegetation descriptions for studies 5 and 6 have been reported in detail (Ohmann and Grigal 1979, 1981). Biomass values were developed directly from vegetation clipped from 6.5-ft^2 (0.6-m^2) plots established each year adjacent to permanent plots used to sample vegetation for phytosociological characteristics.

Numerical

Trees and saplings

For those studies of forest stands old enough to have saplings (1- to 4-in. (2.5 to 10 cm) d.b.h.) and trees (>4 in. (10 cm) d.b.h.), biomass estimation equations were based on the abundant recent literature (table 2). Aboveground total and foliage biomass were estimated separately for each species and summarized for each community type. For uniformity and consistency, we used the same functional relationship for all tree and sapling biomass estimation equations. Because of its wide use, we selected the allometric relationship

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[1] *All tables appear at the end of the text.*

$$y = aD^b \ , \tag{1}$$

where y is mass of a tree component, D is diameter at breast height (d.b.h.), and a and b are regression parameters. When available, general equations from many sites were used (e.g., Crow 1983, Schmitt and Grigal 1981). In some cases our search only indicated one set of equations for a species (e.g., black ash, (Parker and Schneider 1975)). In other cases, several equations, representing a wide geographic range, were available for a species. Regression coefficients were generally similar for a species, independent of location. We pooled the parameters for equations that were similar to arrive at a more generalized expression. The approach was similar to that used by Pastor *et al*. (1984).

The usual method of computation for point-quarter data uses stem diameter and distance from a number of points (usually 20 or more). The data are then summed over all points, and tree density and basal area are calculated on the basis of the aggregated data (Cottam and Curtis 1956). Our approach was to perform the appropriate computations for data from each point. Summary statistics, including mean and standard error (SE), could then be developed over all points. The total biomass for a stratum was the sum of the biomass for each species in the stratum.

For studies 3 and 4, all tree stems greater than 1 in. (2.5 cm) were combined; thus, there is no separate biomass estimate for saplings. In studies 5 and 6, all tree stems were classified as tree seedlings (table 1).

Tall shrubs

Biomass estimation equations for tall shrubs were also of the allometric form. They were based primarily on three studies from northern Minnesota: Balogh (1983), Grigal and Ohmann (1977), and Roussopoulos and Loomis (1979) (table 3). Equations from Telfer (1969) were used for a few less common species. For some common species, all three primary sources contained estimation equations. In those cases, all three equations were plotted and the intermediate equation was selected. Because this was often an equation from Balogh (1983), equations for less common species were also obtained from that source. All equations were based on shrub diameter at 6 in. (15 cm) above the ground.

In studies 1 through 3, tall shrubs were measured in 0.4-in. (1-cm) diameter classes at 6 in. (15 cm) above the ground (Ohmann and Ream 1971a) (table 1). However, other data (Balogh 1983) indicate that the majority of shrubs in smaller size classes are near the lower end of these classes. Use of the allometric function based on 0.4-in. (1-cm) diameter classes would therefore overestimate shrub biomass. We determined diameter-density distributions for each shrub species in studies 1 through 3. The data were fit to a linearized power function

$$\ln(De) = a + b \ln(Di) \ , \tag{2}$$

where ln (De) is the natural log of proportion of total stems of that diameter, and ln (Di) is the natural log of stem diameter. The slope of this equation (b) for each species is the change in proportion of individuals with diameter. Shrub data for a sampling point, in 0.4-in. (1-cm) diameter classes, and the slope (b) of the above relationship were used to compute the expected number of individuals by 0.1-in. (0.25-cm) diameter classes. In study 4 the number of shrub stems by 0.1-in. (0.25-cm) diameter classes were determined directly within each plot (table 1). The biomass estimation equations were then applied to the 0.1-in. (0.25-cm) classes. Biomass was calculated for each tall shrub species on a plot. The means of those plot values were calculated by species and summed for total biomass for the shrub stratum. In studies 5 and 6, the aboveground standing crop of vegetation was sampled during August of each year following fire (only the first year in the case of the summer-season fire, study 6). All shrub vegetation in 10 (20 in study 6) randomly located plots near the permanent sample plots within each stand was clipped at ground level (table 1). All harvested shrub vegetation was returned to the laboratory, sorted, counted, and bagged by species and plot, dried to 70° C to constant weight, and weighed. Means and variances of the samples were calculated for all species in each stand.

Tree seedlings

Tree seedling cover and density were recorded in studies 1 through 4 (table 1). Most published biomass estimation equations for seedlings are based on either diameter (Telfer 1969, Roussopoulos and Loomis 1979) or height (Young *et al*. 1980). We modified the published equations to determine biomass for seedlings from our data.

Our independent variable was cover per individual seedling. We collected samples to determine minimum and maximum biomass and cover for representative deciduous (northern red oak, red maple, quaking aspen, and paper birch) and coniferous (balsam fir, black spruce, jack pine, and white pine) species that were most common as seedlings in the data set.

Relationships from both Roussopoulos and Loomis (1979) and Young *et al*. (1980) were used to determine change in mass with size. Biomass estimation equations of the allometric form were then developed for both foliage mass and for total mass, using cover per individual as the independent variable. In studies 1 through 4, seedling biomass for a stand was calculated similarly to that for tall shrubs. In studies 5 and 6, biomass was determined by clipping and weighing as for tall shrubs (table 1).

Herbs and low shrubs

A series of biomass equations using cover as the independent variable has been developed for herbs, ferns, and low shrubs sampled on 1 × 2-ft (0.2-m^2) plots (Ohmann *et al*. 1981) (table 1). These equations were used for the data from studies 1 through 4. For species for which no equation had been specifically developed, we used equations for similar species (e.g., *Fragaria* spp. equation for *Waldsteinia fragarioides* (Michx.) Tratt.). A miscellaneous herb and fern equation (unpublished) was used for species with no obvious morphological match. For each species, stand biomass was simply the mean of the estimates for each plot (usually 20), and standard error was calculated. Stand totals over all species were calculated as with the other strata. Biomass for studies 5 and 6 was obtained by clipping plots exactly as for shrubs and tree seedlings (table 1).

Mosses and lichens

Cover estimates for both mosses and lichens were also made on 1 × 2-ft (0.2-m^2) plots in studies 1 through 3 (table 1). Based on sampling in northeastern Minnesota, we determined mass per unit area for various moss and lichen species and species groups (Ohmann and Grigal, 1985). These data were then converted to linear relationships between cover and mass on 1 × 2-ft (0.2-m^2) plots. Means and errors were calculated as for the herb stratum. The values obtained are within the range of those reported for jack pine stands on shallow soils in the area (Green and Grigal 1979). Moss and lichen cover was not estimated in study 4 (table 1). In studies 5 and 6, moss and lichen biomasses were determined from the clip plots exactly like those for the other vegetation (table 1).

Each immature stand comprising studies 2 through 6 was assigned to one of 12 forest community types using a classification technique applied earlier to stands in studies 1 and 2 (Grigal and Ohmann 1975). The assignment was made by multiplying the frequency of occurrence of each of the 53 indicator species present in a stand by a classification function for that species (table 4). The sum of those products together with the appropriate constant (table 4) indicated a stand's affinity to each of the 12 community types. Stands were assigned to the community type for which they showed the greatest affinity. The assignment of stands only 1 year from fire or logging disturbance, as well as those 33 years from disturbance was possible because the majority of the 53 indicator species are neither tree nor disturbance-related species.

Tables 5-17 present the estimated aboveground ovendry biomass by species and stratum for each of the 13 community types. Means and standard errors are presented except where a species occurred in only one stand of a community type.

Thirteen community types were recognized in the initial floristic classification (Grigal and Ohmann 1975). The *lichen* community type consists of lichen-covered bedrock outcrops on ridgetops and upper slopes. Although overstory trees are absent, the type contains a few woody seedlings and tall shrubs, and some low shrubs and herbs. The remaining 12 types are forested. The *jack pine-oak* community type occurs in similar physiographic situations as the lichen type, except that sufficient soil is present to support a forest community. The community is dominated by jack pine, with some northern red oak and red maple. Where these stands have been severely disturbed by logging and fire, the coniferous component has been markedly reduced, giving rise to the *maple-oak* community type. Red maple and northern red oak dominate the overstory in this type, but the understory is similar to that in the jack pine-oak type.

Two other community types are dominated by jack pine. The *jack pine-fir* type is on deep soils, and has an overstory of jack pine with balsam fir, paper birch, and black spruce saplings and seedlings. A tall shrub layer is common, and mountain maple and fly honeysuckle are important. Large-leaf aster dominates the herb layer, but a variety of other herbs occur in the type. The *jack pine-black spruce* type, as the name implies, contains an overstory of jack pine with black spruce trees, saplings, and seedlings. Tall shrubs are rare, and moss species rather than herbaceous species dominate the forest floor. In the *black spruce-feather moss* community type, black spruce dominates the overstory although some jack pine is present. Shrubs and herbs are less common than in the previous type, and the moss layer covers the entire forest floor.

Four types are partially to completely dominated by quaking aspen and paper birch. The *aspen-birch* community type is dominated by those two species, although balsam fir seedlings are abundant. Tall shrubs are plentiful, dominated by beaked hazel. Low shrubs, especially bush honeysuckle are also abundant. Large-leaf aster is an important herb species, along with false lily-of-the-valley, wild sarsaparilla, and bunchberry. Mosses are unimportant. The *aspen-birch-white pine* community type is similar to the aspen-birch type, but it contains a component of large white pine and a greater abundance of balsam fir in the overstory. The *maple-aspen-birch* community type contains red maple, especially as a seedling, in addition to quaking aspen and paper birch. Tall shrubs include green alder and mountain maple, in addition to beaked hazel. The type also contains balsam fir, but that species is more important in the *maple-aspen-birch-fir* community type. The type is similar to the maple-aspen-birch type, but mountain maple is more dominant as a tall shrub, low shrubs are less frequent, and bunchberry is the most common herb.

Both the conifer and the broadleaf types previously mentioned appear to occur in a successional sequence to the *fir-birch* community type. Balsam fir is the most common tree, with both paper birch and northern white-cedar as associates. Mountain maple is the dominant tall shrub, and low shrubs are sparse. The herb layer is much reduced compared to the broadleaf types, with bunchberry the most abundant herb. With the decline of the herb stratum, mosses are more abundant. The *white-cedar* community type appears to be even further along the successional sequence than the fir-birch type, and the stands in this type are somewhat older than those in the previously mentioned types. The type is similar to the fir-birch type, but northern white-cedar is more important and the herb stratum is more mixed. Bishop's cap is a common herb.

The final type, *red pine* does not fit well in sequence with the other types. It consists of old-growth red pine with a poorly developed understory resulting in open, nearly park-like stands. White pine is a common associated species. Low ericaceous shrubs are common, as are mosses and lichens.

The validity of our results is predicated in part on the generality of biomass estimation equations. Such generality across sites and even across regions has been examined for trees, and relations between diameter and total aboveground biomass are very consistent for a number of species included in our data set. These species include red maple (Crow 1983), paper birch (Schmitt and Grigal 1981), jack pine (Green and Grigal 1978), black spruce (Grigal and Kernik 1984), red pine (Alban and Laidly 1982), and quaking aspen, white pine, and northern red oak (Pastor *et al*. 1984). These results lend credence to our approach. Extensive tests of generality have not been conducted for most species in the lower forest strata, but in this study most of those equations were derived from data collected in or near the BWCAW.

Biomass productivity and the dynamic biomass relations among and within community types represented by the estimates reported here, along with their wildlife implications, have been discussed elsewhere (Grigal *et al*. 1976; Grigal and Ohmann 1977; Ohmann *et al*. 1976, 1978; Ohmann and Grigal 1977, 1979, 1981, accepted; Ohmann 1982, 1984).

LITERATURE CITED

Alban, D. H.; Laidly, P. R. Generalized biomass equations for jack and red pine in the Lake States. Can. J. For. Res. 12: 913-921; 1982.

Balogh, J. C. Tall shrubs in northern Minnesota. St. Paul, MN: University of Minnesota Soil Science Department; 1983. 140 p. Ph.D. thesis.

Barney, Richard J.; Van Cleve, Keith; Schlentner, Robert. Biomass distribution and crown characteristics in two Alaskan *Picea mariana* ecosystems. Can. J. For. Res. 8 (1): 36-41; 1978.

Baskerville, G. L. Dry matter production in immature balsam fir stands. For. Sci. Monogr. 9: 42 p; 1965.

Bella, I. E.; De Franceschi, J. P. Biomass productivity of young aspen stands in western Canada. Inf. Rep. X-219. Edmonton, Alberta: Canadian Forestry Service, Northern Forest Research Centre; 1980: 1-13.

Cottam, G.; Curtis, J. T. The use of distance measures in phytosociological sampling. Ecology 37: 451-460; 1956.

Crow, T. R. Comparing biomass regressions by site and stand age for red maple. Can. J. For. Res. 13: 283-288; 1983.

Green, D. E.; Grigal, D. F. Jack pine biomass accretion on shallow and deep soils in Minnesota. Soil Sci. Soc. Am. J. 43: 1233-1237; 1979.

Green, D. E.; Grigal, D. F. Generalized biomass estimation equations for jack pine. MN For. Res. Notes 268. St. Paul, MN: College of Forestry; 1978. 4 p.

Grigal, D. F.; Kernik, L. K. Biomass estimation equations for black spruce (*Picea mariana* (Mill.) B.S.P.); For. Res. Note 290. St. Paul, MN: University of Minnesota College of Forestry, 1984. 4 p.

Grigal, D. F.; Ohmann, L. F. Classification, description and dynamics of upland communities within a Minnesota wilderness area. Ecol. Monogr. 45: 389-407; 1975.

Grigal, D. F.; Ohmann, L. F. Biomass estimation for some shrubs from northeastern Minnesota. Res. Note NC-226. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1977. 3 p.

Grigal, D. F.; Ohmann, L. F.; Brander, R. B. Seasonal dynamics of tall shrubs in northeastern Minnesota: biomass and nutrient element change. For. Sci. 22(2): 195-208; 1976.

Harding, R. B. Site quality evaluation for white spruce plantations in northern Minnesota. St. Paul, MN: University of Minnesota College of Forestry; 1982. 135 p. Ph.D. thesis.

Ker, M. F. Tree biomass equations for ten major species in Cumberland, Nova Scotia. Maritime For. Res. Cent. M-X-108. Fredericton, New Brunswick, Canada: Maritime Forest Research Centre; 1980. 26 p.

Kinerson, A. S.; Bartholomew, I. Biomass estimation equations and nutrient composition of white pine, white birch, red maple, and red oak in New Hampshire. Res. Rep. 62. Durham, NH: Agriculture Experiment Station; 1977. 8 p.

Koerper, Greg L.; Richardson, Curtis J. Biomass and net annual production regressions for *Populus grandidentata* on three sites in northern lower Michigan. Can. J. For. Res. 10: 92-101; 1980.

Monteith, D. B. Whole tree weight tables for New York. Res. Rep. 40. Syracuse, NY: State University of New York, Applied Forest Research Institute; 1979. 64 p.

Ohmann, Lewis F. Tall shrub layer biomass in conifer plantations of northeastern Minnesota. Res. Pap. NC-219. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1982. 30 p.

Ohmann, Lewis F. Biomass in conifer plantations of northeastern Minnesota. Res. Pap. NC-247. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1984. 25 p.

Ohmann, L. F.; Grigal, D. F. Some individual plant biomass values from northeastern Minnesota. Res. Note NC-227. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1977. 2 p.

Ohmann, Lewis F.; Grigal, D. F. Early revegetation and nutrient dynamics following the 1971 Little Sioux Forest Fire in northeastern Minnesota. For. Sci. Monogr. 21; 1979. 80 p.

Ohmann, L. F.; Grigal, D. F. Contrasting vegetative responses following two forest fires in northeastern Minnesota. Am. Midl. Nat. 106(1): 54-64; 1981.

Ohmann, Lewis F.; Grigal, D. F. Biomass distribution of unmanaged upland forests in Minnesota. For. Ecol. and Manage. 13: 1985.

Ohmann, Lewis F.; Ream, Robert R. Wilderness ecology: virgin plant communities of the Boundary Waters Canoe Area. Res. Pap. NC-63. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1971a. 55 p.

Ohmann, Lewis F.; Ream, Robert R. Wilderness ecology: method of sampling and summarizing data for plant community classification. Res. Pap. NC-49. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1971b. 14 p.

Ohmann, L. F.; Grigal, D. F.; Brander, R. B. Biomass estimation for five shrubs from northeastern Minnesota. Res. Pap. NC-133. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1976. 11 p.

Ohmann, L. F.; Grigal, D. F.; Brander, R. B. Shrub mass: data variability and changes over time. In: Proceedings, 10th North American Moose Workshop; Duluth, MN: 172-214; 1978.

Ohmann, Lewis F.; Grigal, David F.; Rogers, Lynn L. Estimating plant biomass for undergrowth species of northeastern Minnesota communities. Gen. Tech. Rep. NC-61. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1981. 10 p.

Ohmann, L. F.; Cushwa, C. T.; Lake, R. E.; Beer, J. R.; Brander, R. B. Wilderness ecology: the upland plant communities, woody browse production, and small mammals of two adjacent 33-year-old wildfire areas of northeastern Minnesota. Gen. Tech. Rep. NC-7. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1973. 30 p.

Parker, G. R.; Schneider, G. Biomass and productivity of an alder swamp in northern Michigan. Can. J. For. Res. 5: 403-409; 1975.

Pastor, John P.; Bockheim, J. G. Biomass and production of an aspen-mixed hardwood-spodosol ecosystem in northern Wisconsin. Can. J. For. Res. 11: 132-138; 1981.

Pastor, J.; Aber, J. D.; Mellilo, J. M. Biomass prediction using generalized allometric regressions for some Northeast tree species. For. Ecol. and Manage. 7: 265-274; 1984.

Pollard, D. F. W. Above-ground dry matter production in three stands of trembling aspen. Can. J. For. Res. 2: 27-33; 1972.

Roussopoulos, P. J.; Loomis, R. M. Weights and dimensional properties of shrubs and small trees of the Great Lakes conifer forests. Res. Pap. NC-178. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1979. 6 p.

Schmitt, Mark D. C.; Grigal, D. F. Generalized biomass estimation equations for *Betula papyrifera* Marsh. Can. J. For. Res. 11(4): 837-840; 1981.

Telfer, E. S. Weight-diameter relationships for 22 woody plant species. Can. Bot. 47: 1851-1855; 1969.

Whittaker, R. H.; Woodwell, G. M. Dimension and production relations of trees and shrubs in the Brookhaven Forest, New York. J. Ecol. 56: 1-25; 1968.

Young, Harold E.; Ribe, John H.; Wainwright, Kevin. Weight tables for tree and shrub species in Maine. Misc. Rep. 230. Orono, ME: University of Maine Life Sciences and Agriculture Experiment Station; 1980. 84 p.

Table 1.--Type and source of data used to develop biomass estimates for species and stratum for 13 plant community types of northeastern Minnesota

	Prayer Lake Fire	Little Sioux Fire	Isabella Plantations	Cherokee-Frost Lake	BWCAW[1/]
Age (years)	1	1-5	1-30	33	mature
Number of stands sampled	2	7	53	35	121
Tree foliage & total above-ground biomass	None	None	Stems >1 in. d.b.h. on 20 plotless points	Trees >4 in. d.b.h. 20 plotless points. Saplings 1-4 in. d.b.h. on 20 plotless points	
Tree seedling foliage & total aboveground biomass	Stems clipped in 20 6.5-ft^2 plots	Stems clipped in 10 6.5-ft^2 plots	Percent cover of seedlings <1 in. d.b.h. on 20 milacre plots		
Tall shrub foliage & total aboveground biomass	Stems clipped in 20 6.5-ft^2 plots	Stems clipped in 10 6.5-ft^2 plots	Stems tallied in 0.1 in. diameter classes at 6 in. aboveground in 10 milacre plots	Stems tallied in 0.4 in. diameter classes at 6 in. aboveground in 20 milacre plots	
Herb (foliage) & low shrub (total) biomass	Stems clipped in 20 6.5-ft^2 plots	Stems clipped in 10 6.5-ft^2 plots	Species percent ground cover on 20 2-ft^2 plots		
Moss & lichen foliage biomass	Clipped in 20 6.5 ft^2 plots	Clipped in 10 6.5-ft^2 plots	Not collected	Species percent ground cover on 20 2-ft^2 plots	

[1/] Boundary Waters Canoe Area Wilderness

Table 2.--Source of biomass estimation equations used for tree and sapling strata

Species	Source
Abies balsamea	Baskerville (1965) Ker (1980) Young *et al.* (1980)
Acer rubrum	Crow (1983)
Betula papyrifera	Schmitt and Grigal (1981)
Fraxinus nigra	Parker and Schneider (1975)
Larix laricina	Young *et al.* (1980)
Picea glauca	Harding (1982) Ker (1980) Young *et al.* (1980)
Pinus banksiana	Green and Grigal (1978)
Picea mariana	Barney *et al.* (1978) Grigal and Kernik (1983) Ker (1980)
Pinus resinosa	Alban (personal communication 1982) Ker (1980) Young *et al.* (1980)
Pinus strobus	Kinerson and Bartholomew (1977) Monteith (1979) Young *et al.* (1980)
Populus balsamifera	Bella and De Franceschi (1980)
Populus grandidentata	Koerper and Richardson (1980)
Populus tremuloides	Ker (1980) Pastor and Bockheim (1981) Pollard (1972)
Prunus pensylvanica	Young *et al.* (1980)
Quercus rubra	Monteith (1979) Whittaker and Woodwell (1968)
Sorbus americana (*Prunus pensylvanica* eq.)	Young *et al.* (1980)
Thuja occidentalis	Young *et al.* (1980)
Tilia americana	Koerper and Richardson (1980)

Table 3.--Source of biomass estimation equations used for tall shrub data

Species	Source
Acer spicatum	Balogh (1983)
Alnus crispa	Balogh (1983)
Alnus rugosa	Grigal and Ohmann (1977)
Amelanchier spp.	Balogh (1983)
Comptonia peregrina	Telfer (1969)
Cornus rugosa	Balogh (1983)
Cornus stolonifera (*C. alternifolia* eq.)	Balogh (1983)
Corylus cornuta	Balogh (1983)
Diervilla lonicera	Roussopoulos and Loomis (1979)
Juniperus communis (*Abies balsamea* eq.)	Roussopoulos and Loomis (1979)
Ledum groenlandicum	Telfer (1969)
Lonicera canadensis	Roussopoulos and Loomis (1979)
Lonicera hirsuta	Grigal and Ohmann (1977)
Lonicera oblongifolia	Grigal and Ohmann (1977)
Lonicera villosa (*L. hirsuta* eq.)	Grigal and Ohmann (1977)
Prunus pensylvanica	Grigal and Ohmann (1977)
Prunus pumila (*Lonicera canadensis* eq.)	Roussopoulos and Loomis (1979)
Prunus virginiana	Balogh (1983)
Rhus glabra (*Sorbus americana* eq.)	Roussopoulos and Loomis (1979)
Ribes spp.	Grigal and Ohmann (1977)
Rosa acicularis	Roussopoulos and Loomis (1979)
Salix spp.	Balogh (1983)
Sambucus spp. (*Sorbus americana* eq.)	Roussopoulos and Loomis (1979)
Sorbus americana	Roussopoulos and Loomis (1979)
Spiraea spp.	Telfer (1969)
Taxus canadensis (*Abies balsamea* eq.)	Roussopoulos and Loomis (1979)
Viburnum edule (*Prunus pensylvanica* eq.)	Grigal and Ohmann (1977)
Viburnum rafinesquianum	Balogh (1983)

Table 4.--Classification functions to assign stands into appropriate community types identified in northeastern Minnesota

Indicator species	Aspen-birch-white pine	Aspen-birch	Fir-birch	Maple-aspen-birch	Maple-aspen-fir-birch	Jack pine-oak	Maple-oak	Red pine	Jack pine-fir	Jack pine-black spruce	Black spruce-feather moss	White-cedar
Calliergonella schreberi	-0.0903	-0.3780	0.4420	-0.3151	-0.1918	0.7837	-0.1613	0.3761	0.5763	0.8901	0.6096	0.5268
Cladonia rangiferina	-.5135	-.3474	-.1928	-.4610	-.3965	1.0937	-.1477	.5622	.2689	.4101	.2332	.0972
Cladonia mitis	1.9893	1.7868	1.9739	1.7460	1.7808	5.2556	1.0476	3.0162	1.4204	2.0224	2.1997	2.3909
Dicranum spp.	.4911	.6014	.0936	.6518	.5317	.2368	.3632	.5081	-.0822	-.0415	.1361	-.0051
Polytrichum spp.	-.1437	.0408	-.3713	-.6958	-.6645	.1193	-.2392	-.3610	-.0730	-.3058	-.2431	-.7975
Lycopodium clavatum	.2853	.5116	-.5188	.5444	.2552	-.9534	.1986	.1467	-.4872	-.7065	-.4886	-1.0251
Lycopodium obscurum	-.2733	-.2544	.0046	-.6757	-.5490	1.1345	-.7151	.0516	.2200	.3213	.2377	.2515
Pteridium aquilinum	1.1561	2.0336	.6038	1.2004	.8902	-.4636	.1076	-.1221	.0251	-.4114	.1180	.2706
Aralia nudicaulis	.5007	.4640	.4214	.6571	.5342	-.4128	.4383	.0346	.0948	-.0386	.0906	.5845
Aster macrophyllus	.3937	.3140	.3009	.2752	.1454	.1637	.1270	.1210	.3674	.2065	.2273	.2680
Clintonia borealis	.1203	.1635	-.2513	.2787	.1466	-.4605	.2806	-.0417	-.2182	-.4093	-.3847	-.4070
Cornus canadensis	-.6736	-.6169	.0637	-.7038	-.4629	-.4501	-.4111	-.6665	.0449	-.0603	-.1008	.4459
Fragaria vesca	.2479	.5703	-.1717	.1779	-.0076	-.3006	-.0134	-.0585	-.2226	-.5241	-.3371	-.3225
Galium triflorum	1.6988	1.7966	-.3324	1.5242	.8675	-.2394	.7194	1.0174	-.2504	-.5315	-.3036	-1.1082
Linnaea borealis	-.3621	-.2291	.2201	-.5033	-.3464	.2727	-.4541	-.3646	.1625	.1738	.2060	.4318
Maianthemum canadense	.2499	-.0182	-.1599	.2712	.2165	.0724	.3460	.2722	-.0597	.0722	-.0241	-.3332
Melampyrum lineare	1.1665	.9151	.3369	1.3177	1.0240	.5606	.9463	1.2092	.3502	.3633	.4160	.0566
Mitella nuda	-.3069	-.4460	.7263	-.2426	.0888	.4828	-.0429	-.1122	.4573	.5915	.5013	2.0189
Trientalis borealis	-.9979	-.8824	-.2187	-.9076	-.6809	.3780	-.3989	-.4890	-.0283	.0838	.0229	.3994
Viola spp.	-1.3748	-1.4491	-.0920	-1.4095	-.8465	.4470	-.5823	-.6440	.0837	.2571	.0473	.5383
Streptopus roseus	.8397	.9342	-.0201	.5864	.2956	-.0739	.0112	.6923	-.1136	-.0439	.0656	-.9285
Gaultheria procumbens	-.4103	-.0873	-.2856	-.9505	-.8432	1.5910	-.5420	.1742	-.0706	-.0830	-.0059	-.2154
Rubus strigosus	-1.0433	-.8948	.5142	-.8499	-.3914	.8119	-.4625	-.2654	.4621	.8624	.6421	.8716
Rubus pubescens	-.3224	-.1877	.0386	-.9632	-.7938	.9043	-.7115	-.3015	.3147	.2474	.2350	.2965
Vaccinium angustifolium	-.9636	-1.1873	-.1084	-.9776	-.5946	1.0526	-.3206	.1780	-.0036	.4432	.1920	.2742
Vaccinium myrtilloides	-.5944	-.5888	-.3624	-.5836	-.5765	-1.8859	-.2530	-1.3408	-.2126	-.5522	-.6119	-.2892
Diervilla lonicera	.3362	.6351	.1233	.2976	.2004	.2402	.0364	.0336	.1098	-.1196	.0456	.0255
Abies balsamea (S)1/	.3263	.2547	.2153	.3348	.3325	-.0484	.1863	.0984	-.0488	-.0088	.1438	.2333
Acer rubrum (S)	-.0265	-.1992	-.0292	.7124	.7136	-.2496	.5497	.3272	-.1400	.0462	-.1130	-.0030
Betula papyrifera (S)	-.0794	-.3542	.3245	-.2873	-.0530	.2134	-.1346	-.0976	.2301	.3138	.2903	.6389
Picea glauca (S)	.5360	.2296	-.0702	.1008	-.1386	.2511	-.0216	.5873	.2078	.1991	.2149	-.3642
Picea mariana (S)	-.9088	-.9331	-.5845	-.8006	-.6463	.5108	-.2687	-.0243	-.2146	.0327	-.1835	-.4959
Pinus strobus (S)	.2888	.5700	.1181	.3669	.2153	-.5553	-.0017	-.0708	-.0382	-.1969	-.0956	-.2054
Populus tremuloides (S)	.4541	.6895	-.0240	.2672	.1329	.3265	.0349	.2952	.0136	-.1291	-.0085	-.2881
Thuja occidentalis (S)	-.1160	-.0503	.3086	.0409	.0694	-.1941	-.0611	-.0708	.1416	.0709	.1181	.8737
Quercus rubra (S)	.1265	.0537	.2032	.2732	.1046	-.7440	.3809	-.0155	-.0082	-.1401	-.0777	.1569
Acer spicatum	.1967	.1604	.5146	.5133	.5440	.0771	.4430	.3185	.2286	.2885	.3179	.6931
Alnus crispa	.0987	.4195	-.1157	.5654	.3123	-.4360	.1706	.3763	-.2503	-.2387	-.1158	-.3338
Amelanchier spp.	-.5840	-.6236	-.3453	-.7123	-.4157	.4973	-.0711	-.1733	.0696	.1564	-.0698	-.3236
Cornus rugosa	-.4043	-.3280	-.3508	-.6338	-.6781	-.1307	-.4636	-.3303	-.0917	-.1249	-.1626	-.3614
Corylus cornuta	.0022	-.0765	.2353	.0551	.0937	.2555	.0481	.1723	.1799	.3524	.2847	.3612
Lonicera canadensis	-.6864	-.8248	-.4273	-.7290	-.6125	-.1990	.0564	-.5220	-.1494	-.2195	-.4369	-.2098
Salix spp.	-.1754	-.3397	-.0480	-1.3962	-1.2092	.2529	-.7527	-1.0611	.2654	-.0766	-.0073	.3905
Populus tremuloides (T)	.7950	.7483	.1599	1.0487	.8616	-.1711	.5677	.6049	.0027	.0457	.1388	-.1579
Betula papyrifera (T)	1.1644	1.2591	.5830	1.1523	.8694	.0645	.4404	.6662	.2776	.1345	.3595	.2971
Abies balsamea (T)	.6302	.6948	.4677	.5584	.5177	.1859	.2920	.3499	.3312	.1713	.2909	.2457
Thuja occidentalis (T)	.3133	.3119	.8577	.3432	.4914	.7283	.1869	.3076	.5547	.6218	.6385	1.3728
Pinus banksiana (T)	.2012	-.0439	.1315	.2378	.2813	.1372	.2302	.2519	.3005	.4015	.1479	.1592
Picea glauca (T)	.4138	.5196	-.1152	.6869	.4432	-.8575	.2395	-.0893	-.2459	-.5936	-.3820	-.1714
Picea mariana (T)	.3650	.2754	.6489	.3673	.4928	.3494	.2426	.3848	.3844	.6265	.6685	.7407
Pinus resinosa (T)	.6742	.3823	.1344	.7702	.5826	.4093	.5975	1.2845	.1108	.2915	.2838	-.0877
Pinus strobus (T)	1.0096	.7417	.3527	.9743	.3111	.0072	.4813	.9342	.1039	.2039	.2999	.1565
Acer rubrum (T)	1.2837	1.3708	.5701	1.5662	1.2423	-.2180	.8816	.5616	.1884	-.0685	.2520	.4052
Constant	-140.9238	-152.5211	-95.9515	-169.9262	-130.0939	-205.5043	-95.6863	-154.3386	-61.7259	-90.2644	-77.3991	-179.2447

1/(T) Tree size class (>1 in. d.b.h.)
(S) Seedling size class (<1 in. d.b.h.)

Table 5.--Aboveground ovendry biomass by species and stratum for the lichen community type of northeastern Minnesota

(In Kg/ha)

	BWCAW Mature (n = 6)			
	Foliage		Total	
Stratum/Species	X̄	SE	X̄	SE
Tree seedling				
Acer rubrum L.	0.5	-	16.0	-
Betula papyrifera Marsh.	.1	-	2.6	-
Pinus banksiana Lamb.	.6	-	4.6	4.6
Populus tremuloides Michx.	.5	-	2.8	-
Quercus rubra L.	.3	-	1.5	-
Sorbus americana Marsh.	.1	-	.7	-
Stratum Total	2.1		28.2	
Tall shrub				
Acer spicatum Lam.	<.1	-	<.1	-
Amelanchier Medic. spp.	<.1	-	.2	.2
Prunus pensylvanica L.F.	<.1	-	<.1	-
Salix bebbiana Sarg.	<.1	-	.1	-
Salix L. spp.	1.0	-	1.2	-
Stratum total	1.1		1.6	
Low shrub				
Diervilla Lonicera Mill.			54.4	53.4
Rubus strigosus Michx.			3.5	-
Vaccinium angustifolium Ait.			37.9	18.7
Stratum total			95.8	
Herb				
Anemone quinquefolia L.	<.1	-		
Aralia hispida Vent.	1.9	-		
Aralia nudicaulis L.	.2	-		
Aster macrophyllus L.	.3	-		
Carex L. spp.	5.0	2.3		
Corydalis sempervirens (L.) Pers.	.5	.3		
Goodyera tesselata Lodd.	.4	-		
Grasses	40.6	14.5		
Maianthemum canadense Desf.	.2	-		
Melampyrum lineare Desr.	.2	-		
Potentilla tridentata Soland.	.3	-		
Streptopus roseus Michx.	.2	-		
Trientalis borealis Raf.	<.1	-		
Stratum total	49.9			
Moss				
Calliergonella schreberi (Willd., BR. & Sch.) Grout	7.1	5.2		
Dicranum Hedw. spp.	2.6	-		
Polytrichum Hedw. spp.	283.2	95.3		
All other mosses	360.4	118.5		
Stratum total	653.3			
Lichen				
Cladonia mitis Sandst.	939.1	325.7		
Cladonia rangiferina (L.) Web.	1,535.1	324.2		
Peltigera aphthosa (L.) Willd.	90.2	41.8		
All other lichens	743.8	161.6		
Stratum total	3,308.2			
Community total			4,137.0	

Table 6.--Aboveground ovendry biomass by species and stratum for the aspen-birch-white pine community type of northeastern Minnesota

(In Kg/ha)

	Little Sioux Fire												Cherokee-Frost Lake				BWCAW			
	1				3				5				33				MATURE			
	n = 1				n = 1				n = 1				n = 7				n = 16			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Tree																				
Abies balsamea (L.) Mill.													60.7	45.4	520.4	388.1	807.2	272.8	6,362.5	2,143.3
Acer rubrum L.																	5.8	3.4	208.7	127.2
Betula papyrifera Marsh.													946.0	227.8	34,570.4	9,405.4	871.0	296.3	22,483.4	7,943.6
Picea glauca (Moench) Voss.													94.1	38.0	661.4	250.9	867.4	245.3	7,979.9	2,270.7
Picea mariana (Mill.) B.S.P.													39.3	37.8	285.5	274.0	138.4	97.5	1,077.9	758.0
Pinus banksiana Lamb.													712.2	348.5	11,870.7	5,505.5	1,095.2	693.2	23,805.2	14,566.4
Pinus resinosa Ait.																	1,099.0	512.9	15,619.2	7,127.4
Pinus strobus L.													2.4	-	45.9	-	2,757.6	1,023.7	6,160.0	22,621.0
Populus grandidentata Michx.																	6.4	5.8	364.8	331.9
Populus tremuloides Michx.													919.4	246.6	29,602.5	7,576.0	643.4	161.1	33,063.2	9,535.6
Thuja occidentalis L.																	2.8	-	22.3	-
Stratum Total													2,774.1		77,556.8		8,294.2		172,147.1	
Sapling																				
Abies balsamea (L.) Mill.													12.4	10.2	109.3	89.7	196.4	95.6	1,648.6	800.8
Acer rubrum L.																	5.6	2.7	108.6	55.7
Betula papyrifera Marsh.													291.5	166.9	10,693.2	6,156.5	228.4	87.9	8,238.8	3,115.2
Picea glauca (Moench) Voss.													200.0	112.5	1,305.4	719.1	63.9	22.9	421.0	150.7
Picea mariana (Mill.) B.S.P.													33.3	-	189.8	-	37.9	21.6	224.9	130.0
Pinus banksiana Lamb.													4.5	-	47.6	-	2.7	2.0	30.2	21.8
Pinus resinosa Ait.																	6.9	-	68.4	-
Pinus strobus L.																	7.1	5.4	127.0	95.6
Populus grandidentata Michx.																	.2	-	8.5	-
Populus tremuloides Michx.													203.2	104.0	5,291.4	2,744.0	63.2	42.2	1,641.4	1,087.5
Sorbus americana Marsh.													<.1	<.1	<.1	<.1	.9	.6	9.4	6.5
Thuja occidentalis L.													39.3	36.2	153.1	144.6	.9	-	4.3	-
Stratum Total													784.3		17,789.9		614.1		12,531.1	

	Little Sioux Fire												Cherokee-Frost Lake				BWCAW			
	1				3				5				33				MATURE			
	n = 1				n = 1				n = 1				n = 7				n = 16			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Tree Seedling																				
Abies balsamea (L.) Mill.													51.4	22.1	130.6	56.7	32.2	8.4	67.6	19.5
Acer rubrum L.					11.8		40.2		<0.1		1.5		.1	<.1	1.6	.8	.7	.3	11.2	4.5
Betula papyrifera Marsh.			45.0		50.0		104.5		261.4		1,035.4		5.4	1.3	127.2	34.4	1.7	.7	41.0	17.1
Fraxinus nigra Marsh.																	1.0	.6	7.8	6.2
Picea glauca (Moench) Voss.													30.5	12.6	63.6	27.5	5.4	1.2	9.2	2.2
Picea mariana (Mill.) B.S.P.											18.0		7.4	5.1	14.6	10.1	5.3	3.1	9.5	5.8
Pinus banksiana Lamb.			<.1		<.1		.1		.3		.5		.5	.3	3.0	1.9				
Pinus resinosa Ait.																	.1	.1	.9	.7
Pinus strobus L.											522.3		.8	-	7.3	-	1.9	.5	10.6	2.9
Populus grandidentata Michx.					44.5		160.8													
Populus tremuloides Michx.			1.4		58.7		169.5		174.6		1,164.4		4.3	1.6	25.0	9.9	7.4	1.7	44.8	11.8
Sorbus americana Marsh.													.6	.2	3.0	1.2	1.1	.5	5.9	2.3
Thuja occidentalis L.													18.8	12.5	52.1	34.1				
Stratum Total			46.5		165.1		475.1		436.4		2,742.1		119.8		428.0		56.8		208.5	
Tall Shrub																				
Acer spicatum Lam.													27.1	11.9	193.9	90.3	57.9	37.4	632.1	441.7
Alnus crispa (Ait.) Pursh.													.1	-	.1	-	6.6	3.0	46.6	21.2
Amelanchier Medic. spp.													<.1	<.1	.2	.1	6.3	3.4	65.3	32.8
Cornus rugosa Lam.													.4	.3	.8	.5	8.3	5.0	41.2	25.0
Cornus stolonifera Michx.																	<.1	-	<.1	-
Corylus cornuta Marsh.			9.3		383.4		1,034.5		568.2		1,733.8		90.4	38.2	633.3	263.7	60.0	13.3	354.9	86.5
Lonicera canadensis Marsh.							3.8		47.9		119.4		1.7	.6	5.5	1.9	1.5	.8	7.1	4.2
Lonicera hirsuta Eat.																	.1	.1	.1	.1
Lonicera oblongifolia (Goldie) Hook.													.1	-	.1	-				
Lonicera villosa (Michx.) R.dS.																	.1	.1	.1	.1
Prunus pensylvanica L.F.			5.4		48.8		104.9		18.2		55.9		15.2	8.3	110.9	60.2	<.1	-	<.1	-
Viburnum rafinesquianum Schult.																	.6	.5	3.1	2.8
Stratum Total			14.7		432.2		1,143.2		635.3		1,909.1			151.9		1,035.2	143.3		1,164.4	

(Table 6 continued on next page)

(Table 6.--continued)

	Little Sioux Fire												Cherokee-Frost Lake				BWCAW			
	1 n = 1				3 n = 1				5 n = 1				33 n = 7				MATURE n = 16			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Low Shrub																				
Arctostaphylos Uva-ursi (L.) Soreng.																			0.7	-
Chimaphila umbellata (L.) Bart.			<0.1				27.8								0.9	0.5			.4	0.2
Comptonia peregrina B.&B. Small. Rydb.			.2				51.2				283.1									
Diervilla Lonicera Mill.			.7				15.5				24.8				18.3	8.7			43.0	7.1
Gaultheria procumbens L.							16.7												.8	-
Juniperus communis L.																			16.0	-
Ribes triste Pall.							.3								<.1	-				
Ribes L. spp.															.2	-			.4	-
Rosa acicularis Lindl.							14.7				26.5				2.5	1.0			3.2	1.0
Rubus parviflorus Nutt.																			6.6	3.5
Rubus pubescens Raf.			.4				6.0								5.8	2.6			1.2	.5
Rubus strigosus Michx.			239.4				264.3				207.5				4.5	2.0			2.7	1.5
Vaccinium angustifolium Ait.			2.0				7.3												3.8	1.2
Vaccinium myrtilloides Michx.			5.6								104.8				1.8	-			12.6	6.9
Stratum Total			248.4				403.8				646.7				34.1				91.4	
Herb																				
Actaea rubra (Ait.) Willd.													1.0	0.9			0.2	0.2		
Anaphalis margaritacea (L.) C.B. Clarke													3.8	1.8			.1	-		
Anemone quinquefolia L.					0.4								<.1	-			.3	.3		
Antennaria spp. Gaertn.																	.4	-		
Apocynum androsaemifolium L.													1.1	.7			.1	.1		
Aquilegia canadensis L.																	.1	-		
Aralia hispida Vent.									8.0											
Aralia nudicaulis L.	66.5				84.7				72.8				44.2	10.3			24.7	4.6		

	Little Sioux Fire												CHEROKEE-FROST LAKE				BWCAW			
	1 n = 1				3 n = 1				5 n = 1				33 n = 7				MATURE n = 16			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Asarum canadense L.																	0.5	-		
Aster ciliolatus Lindl.													0.4	0.2			1.4	0.7		
Aster macrophyllus L.	454.8				169.7				254.1				231.7	44.6			208.2	31.4		
Carex L. spp.	86.0				105.0				11.0				2.9	1.7			3.0	1.8		
Circaea alpina L.																	.3	-		
Clematis viginiana L.																	.2	-		
Clintonia borealis (Ait.) Raf.	16.3				20.4				31.6				1.6	.8			2.6	1.2		
Coptis groenlandica (Oeder) Fern.									.6				.7	-			.7	.6		
Cornus canadensis L.	47.3				101.9				262.2				14.4	5.7			6.2	1.7		
Epilobium angustifolium L.	4.0												14.9	7.5			.1	-		
Fragaria vesca L.	.9				.4				17.1				1.4	.8			7.8	2.4		
Fragaria virginiana Duchesne.																	.3	.2		
Galium triflorum Michx.	1.8								1.1				.2	.1			.7	.4		
Geranium bicknellii Britt.	32.1				9.1															
Goodyera repens (L.) R. Br.													.7	.4			.4	.2		
Goodyera tesselata Lodd.													.1	-			.2	.1		
Grasses					35.6				33.5				47.6	20.0			50.9	6.7		
Lactuca canadensis L.																	<.1	-		
Lathyrus ochroleucus Hook.													1.0	.6			3.6	1.1		
Lathyrus venosus Muhl.	.4																1.4	.9		
Linnaea borealis L.	3.9				20.0				1.3				5.6	3.3			8.1	2.2		
Maianthemum canadense Desf.	6.1				26.3				21.4				3.9	1.1			7.4	1.4		
Melampyrum lineare Desr.									.1				1.1	.7			1.4	.5		
Mitella nuda L.													.2	-			1.6	1.0		
Petasites palmatus (Ait.) Gray																	.1	-		
Petasites vitifolius Rydb.																	.5	-		
Polygala paucifolia Willd.																	.1	.1		
Polygonum cilinode Michx.	2.3				<.1															
Pyrola asarifolia Michx.																	<.1	-		
Pyrola elliptica Nutt.													.1	-			.1	.1		
Pyrola minor L.													.5	.4			<.1	-		
Pyrola rotundifolia L.													.2	.1			.4	.2		
Pyrola secunda L.	.9																.1	.1		
Pyrola virens Schweigg.																				

(Table 6 continued on next page)

(Table 6.--continued)

	Little Sioux Fire												Cherokee-Frost Lake				BWCAW MATURE			
	1 n = 1				3 n = 1				5 n = 1				33 n = 7				n = 16			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE
Pyrola L. spp.					8.7				3.1											
Solidago hispida Muhl.													0.2	-						
Streptopus roseus Michx.									.6				3.0	1.5			0.8	0.3		
Taraxacum Zinn. spp.													.1	-						
Trientalis borealis Raf.	1.4				1.7				1.4				.6	.5			<.1	<.1		
Trifolium repens L.																	<.1	-		
Trillium grandiflorum (Michx.) Salisb.																	.1	-		
Vicia americana Muhl.																	.2	.2		
Viola L. spp.	.1												.4	.2			.3	.1		
Waldsteinia fragarioides (Michx.) Tratt.													.1	-			.1	.1		
Stratum total	724.8				584.0				719.9				383.8				335.8			
Fern and fern allies																				
Botrychium virginianum (L.) Sw.																	.4	-		
Dryopteris spinulosa (O.F. Muell.) Watt																	.3	.2		
Lycopodium annotinum L.													.4	-			1.7	-		
Lycopodium clavatum L.													4.1	2.5			1.4	1.0		
Lycopodium complanatum L.	3.8				1.0												.3	-		
Lycopodium lucidulum Michx.																	<.1	<.1		
Lycopodium obscurum L.	12.7				35.3				199.1								1.0	.5		
Osmunda claytoniana L.																	.1	<.1		
Polypodium virginianum L.													.1	-			.1	-		
Pteridium aquilinum (L.) Kuhn.									32.7				3.2	2.7			36.7	12.5		
Woodsia ilvensis (L.) R. Br.																	.1	-		
Stratum total	16.5				36.3				231.8				7.8				42.2			
Moss																				
Calliergonella schreberi (Willd., Br. & Sch.) Grout													106.2	28.1			221.6	62.5		
Dicranum Hedw. spp.													29.9	13.3			25.3	9.5		
Hylocomium splendens (Hedw.) B.S.G.													1.6	-						
Hypnum crista-castrensis Hedw.													1.4	.7			1.1	.6		
Polytrichum Hedw. spp.	0.2				1.1				0.5	0.5			56.0	30.1			4.2	2.0		
All other mosses													104.8	33.1			268.9	57.4		
Stratum total	.2				1.1				.5				299.9				521.1			
Lichen																				
Cladonia alpestris (L.) Rabenh.													2.3	-			21.2	20.1		
Cladonia mitis Sandst.													.8	-			6.9	3.4		
Cladonia rangiferina (L.) Web.													27.2	21.2						
Cladonia sylvatica (L.) Hoffm.													15.1	-						
Peltigera aphthosa (L.) Willd.																	.6	-		
All other lichens													44.8	15.9			17.5	7.2		
Stratum total	.2												90.2				46.2			
Unidentified																				
Community total			1,051.3				2,043.5				6,250.1				97,625.7				187,087.8	

Table 7.--Aboveground ovendry biomass by species and stratum for the aspen-birch community type of northeastern Minnesota

(In Kg/ha)

	Little Sioux Fire											
	1 n = 2				3 n = 2				5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree												
Abies balsamea (L.) Mill.												
Acer rubrum L.												
Betula papyrifera Marsh.												
Picea glauca (Moench) Voss.												
Picea mariana (Mill.) B.S.P.												
Pinus banksiana Lamb.												
Pinus resinosa Ait.												
Pinus strobus L.												
Populus grandidentata Michx.												
Populus tremuloides Michx.												
Thuja occidentalis L.												
Stratum total												
Sapling												
Abies balsamea (L.) Mill.												
Betula papyrifera Marsh.												
Fraxinus nigra Marsh.												
Picea glauca (Moench) Voss.												
Picea mariana (Mill.) B.S.P.												
Pinus banksiana Lamb.												
Pinus strobus L.												
Populus balsamifera L.												
Populus grandidentata Michx.												
Populus tremuloides Michx.												
Stratum total												

	Little Sioux Fire											
	1 n = 2				3 n = 2				5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree seedling												
Abies balsamea (L.) Mill.												
Acer rubrum L.			62.7	7.6	241.2	83.0	574.7	265.4	400.6	164.2	1,526.4	806.6
Betula papyrifera Marsh.			2.4	-	3.2	-	7.9	-	207.0	-	785.4	-
Fraxinus nigra Marsh.												
Picea glauca (Moench) Voss.												
Picea mariana (Mill.) B.S.P.												
Pinus banksiana Lamb.			.2	.1	36.8	-	61.2	-	133.4	133.2	282.8	282.4
Pinus strobus L.												
Populus grandidentata Michx.			110.4	-	165.4	3.1	704.2	95.8	671.8	324.1	3,094.7	1,141.9
Populus tremuloides Michx.			843.6	692.2	543.8	519.4	1,075.2	966.3	1,112.4	570.1	7,360.2	4,773.6
Quercus rubra L.												
Sorbus americana Marsh.												
Stratum total			1,019.3		990.4		2,423.2		2,525.2		13,049.5	
Tall shrub												
Acer spicatum Lam.			23.1	-								
Alnus crispa (Ait.) Pursh.												
Alnus rugosa (DuRoi) Spreng.												
Amelanchier Medic. spp.					10.2	-	38.4	-				
Cornus rugosa Lam.												
Cornus stolonifera Michx.												
Corylus cornuta Marsh.			45.2	34.6	391.4	74.7	1,253.2	494.2	347.0	120.1	1,266.5	590.1
Lonicera canadensis Marsh.			19.1	-	20.7	20.2	44.4	43.4	69.6	64.6	169.1	160.1
Lonicera hirsuta Eat.												
Lonicera oblongifolia (Goldie) Hook.												
Lonicera villosa (Michx.) R.dS.												
Prunus pensylvanica L.F.			59.9	55.2	151.8	4.8	574.8	94.0	144.2	83.6	576.9	319.7
Prunus virginiana L.												

Isabella Plantations												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												362.6	153.0	2,802.9	1,182.0
				71.3		955.4		109.3		1,537.2					
48.6		1,397.5						356.7		8,928.7		607.6	169.1	15,449.0	4,166.5
2,288.6		21,140.7						16.8		93.0		369.8	169.1	3,426.9	1,555.8
												300.4	195.9	2,478.9	1,523.7
371.5		6,758.6		203.1		1,402.8		1,235.8		21,379.2		511.9	363.2	13,509.8	9,986.0
				1,740.7		17,913.1		1,319.2		15,259.1		74.7	49.9	1,180.0	793.7
												186.2	158.3	4,288.9	3,679.5
.8		23.5										18.8	13.2	1,282.2	910.9
72.8		1,161.8		539.4		11,327.7		461.5		13,367.6		1,423.2	294.6	74,407.0	16,318.2
												4.9	-	38.8	-
2,782.3		30,482.1		2,554.5		31,599.0		3,499.3		60,564.8		3,860.3		118,864.4	
												23.4	10.9	197.6	91.9
												114.9	20.2	4,200.9	746.5
												<.1	<.1	.3	.2
												22.3	10.5	147.3	68.8
												30.8	23.8	180.1	142.4
												1.8	1.0	14.1	8.0
												7.2	4.7	125.2	82.5
												.9	-	25.8	-
												1.6	.8	66.5	35.0
												145.4	37.2	3,750.4	1,008.2
												348.4		8,708.2	

Isabella Plantations												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												16.8	9.3	37.3	20.9
				99.6		845.8						.1	.1	1.4	1.1
												.9	.3	22.3	8.6
												.2	-	1.0	-
												8.4	7.4	16.9	15.3
												3.6	2.7	6.5	5.0
												.7	-	5.2	-
60.9		460.5		65.3		440.0		<0.1		0.6		22.2	10.4	141.5	74.8
												.1	-	.4	-
												.5	.3	2.6	1.4
60.9		460.5		164.9		1,285.8		<.1		.6		53.5		235.1	
								48.6		412.4		38.1	16.1	294.2	131.8
44.2		434.5										88.0	30.8	767.7	296.6
												6.7	-	65.1	-
52.0		475.4		.8		3.6		78.1		1,093.7		22.9	8.3	233.7	83.3
1.8		6.4		148.9		803.5		8.0		34.6		24.7	9.7	154.9	67.7
												1.1	.8	5.9	4.2
234.2		2,075.4		146.5		1,299.4		343.2		2,821.0		195.5	42.8	1,190.7	271.2
								6.0		41.3		1.3	.5	5.1	2.2
												.2	.2	.1	.1
<.1		.1													
5.2		24.4										<.1	-	.1	-
<.1		.4						19.4		185.8		11.9	4.4	86.4	32.0
9.0		46.6										8.0	6.1	120.1	94.6

(Table 7 continued on next page)

(Table 7.--continued)

	Little Sioux Fire											
	1 n = 2				3 n = 2				5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total	
	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE
Salix bebbiana Sarg.												
Salix L. spp.												
Taxus canadensis Marsh.												
Viburnum rafinesquianum Schult.												
Stratum Total			147.3		574.1		1,910.8		560.8		2,012.5	
Low Shrub												
Arctostaphylos Uva-ursi (L.) Spreng.												
Chimaphila umbellata (L.) Bart.												
Comptonia peregrina B.&B. Small. Rydb.			.1	0			37.0	-			149.6	149.2
Diervilla Lonicera Mill.			.4	0			.2	-			21.1	-
Gaultheria procumbens L.			.3	-								
Ribes triste Pall.												
Ribes L. spp.												
Rosa blanda Ait.												
Rosa acicularis Lindl.												
Rubus parviflorus Nutt.												
Rubus pubescens Raf.			.2	-			9.4	-			<.1	-
Rubus strigosus Michx.			25.8	22.9			182.0	167.4			191.5	124.9
Vaccinium angustifolium Ait.			7.2	-			25.4	23.8			25.7	24.2
Vaccinium myrtilloides Michx.			.2	-			8.0	-			10.8	-
Stratum Total			34.2				262.0				398.8	

	Little Sioux Fire											
	1 n = 2				3 n = 2				5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total	
	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE
Herb												
Actaea rubra (Ait.) Willd.												
Anaphalis margaritacea (L.) C.B. Clarke												
Anemone quinquefolia L.												
Antennaria spp. Gaertn.												
Apocynum androsaemifolium L.												
Aralia hispida Vent.	1.8	1.6			52.8	2.8			20.8	-		
Aralia nudicaulis L.	7.8	.8			37.4	2.1			40.6	31.3		
Asarum canadense L.												
Aster ciliolatus Lindl.												
Aster macrophyllus L.	235.3	53.8			139.4	29.6			71.7	.9		
Carex L. spp.	13.1	1.2			71.4	31.1			1.6	-		
Clintonia borealis (Ait.) Raf.	4.4	2.0			55.2	32.4			41.8	6.0		
Coptis groenlandica (Oeder) Fern.	.1	-										
Cornus canadensis L.	30.0	3.6			67.7	11.6			104.2	41.2		
Corydalis sempervirens (L.) Pers.	9.5	1.6										
Epilobium angustifolium L.					21.7	-			18.6	-		
Fragaria vesca L.					.1	-						
Fragaria virginiana Duchesne.												
Galium triflorum Michx.	.2	-										
Geranium bicknellii Britt.	83.4	64.8			.1	-			.7	-		
Goodyera repens (L.) R. Br.												
Grasses	.1	-			40.5	35.5			4.9	.4		
Hepatica americana (D.C.) Ker.												
Hieracium scabrum Michx.												

Isabella Plantations												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE
												1.2	0.8	5.4	4.0
0.1		0.2		100.2		1,127.6						.2	.1	.2	.1
												.3	-	.4	-
												3.6	2.2	22.0	14.3
346.6		3,063.4		396.4		3,234.1		503.3		4,588.8		403.8		2,952.0	
														1.6	-
		10.3												.2	.1
						21.0								4.0	-
		36.2				53.1								107.4	34.4
														<.1	-
														.4	-
		.7				27.6									
		16.4				93.9				37.4				6.4	2.0
						140.7									
		.1								<.1				5.8	2.7
		7.4				10.3								16.8	13.7
		2.7				4.6				5.2				10.2	6.6
										12.6				14.4	9.8
		73.8				351.2				55.3				167.3	

Isabella Plantations												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE
												0.2	-		
<0.1												.3	0.2		
.5								<.1				1.0	1.0		
												.6	.5		
												2.3	1.3		
.3								33.3				34.0	8.5		
												2.4	-		
												1.3	.9		
83.8				151.4				83.7				188.5	35.8		
<.1												8.3	2.9		
								25.6				9.7	3.2		
												4.0	3.0		
				.7				.9				7.3	2.3		
				.2								2.4	1.6		
1.9												10.9	2.6		
3.0				4.0								.1	-		
												1.4	1.1		
												.1	-		
105.7				149.9				68.9				81.5	18.7		
												1.1	.9		
												.7	-		

(Table 7 continued on next page)

(Table 7.--continued)

	Little Sioux Fire											
	1 n = 2				3 n = 2				5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Lactuca canadensis L.												
Lactuca L. spp.												
Lathyrus ochroleucus Hook.												
Lathyrus venosus Muhl.	.1	-										
Lathyrus L. spp.												
Linnaea borealis L.	1.1	1.0			0.4	0.2			0.6	-		
Lysmachia ciliata L.												
Maianthemum canadense Desf.	1.6	.5			5.2	.4			13.6	4.6		
Melampyrum lineare Desr.												
Mitella nuda L.												
Moneses uniflora (L.) Gray												
Petasites palmatus (Ait.) Gray												
Petasites vitifolius Rydb.												
Polygonatum pubescens (Willd.) Pursh												
Polygonum cilinode Michx.	104.0	53.4			174.7	2.7			4.5	.3		
Prunella vulgaris L.												
Pyrola elliptica Nutt.												
Pyrola rotundifolia L.												
Pyrola secunda L.	<.1	-										
Pyrola virens Schweigg.												
Pyrola L. spp.									1.4	.2		
Sanicula marilandica L.												
Streptopus roseus Michx.	.3	-			1.1	-			.9	-		
Taraxacum Zinn. spp.												
Trientalis borealis Raf.	.1	-			.6	.1			.1	-		
Trifolium repens L.												
Uvularia sessilifolia L.												
Vicia americana Muhl.									1.1	-		
Viola L. spp.	0.3	0.2			0.2	-						
Stratum total	493.3				668.5				327.1			
Fern and fern allies												
Athyrium filix-femina (L.) Roth.												
Dryopteris spinulosa (O.F. Muell.) Watt												
Equisetum L. spp.												
Lycopodium annotinum L.												
Lycopodium clavatum L.												
Lycopodium complanatum L.									1.2	.6		
Lycopodium obscurum L.	3.2	3.1			12.2	-			19.4	-		
Osmunda claytoniana L.												
Polypodium virginianum L.												
Pteridium aquilinum (L.) Kuhn.												
Stratum total	3.2				12.2				20.6			
Moss												
Calliergonella schreberi (Willd., BR. & Sch.) Grout												
Dicranum Hedw. spp.												
Polytrichum Hedw. spp.	0.1	-			0.1	-			12.6	2.2		
All other mosses												
Stratum total	.1				.1				12.6			
Lichen												
Cladonia mitis Sandst.												
Cladonia rangiferina (L.) Web.												
All other lichens												
Stratum total												
Unidentified plants	.1	-										
Community total			1,697.5				5,276.8				15,821.1	

Isabella Plantations												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												0.2	-		
												.1	-		
13.2				25.5				1.4				3.6	2.2		
				32.8								1.5	1.4		
5.0															
				2.3								4.5	2.6		
												.9	.7		
				1.6				5.3				5.9	1.2		
												.7	.3		
												2.1	1.6		
												.1	-		
												.1	.7		
												.1	-		
												1.0	-		
												.1	-		
												.2	.1		
												.2	-		
												.3	.2		
												<.1	-		
												1.8	-		
								.2				1.4	.6		
												.2	.2		
												.5	.2		
												.1	-		

Isabella Plantations												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												0.1	-		
												.3	.2		
213.5				368.4				219.6				385.5			
												2.0	1.9		
												.4	-		
												.2	.1		
												.2	-		
				.3								.9	.6		
												2.7	2.0		
												3.3	-		
												1.9	-		
				376.3				138.5				93.7	19.3		
				376.6				138.5				105.3			
												43.8	19.9		
												2.9	1.6		

ISABELLA PLANTATIONS												BWCAW			
6-10 n = 1				11-15 n = 1				21-25 n = 1				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												21.8	13.1		
												298.3	52.7		
												366.8			
												4.8	-		
												11.6	8.4		
												27.5	11.1		
												43.9			
												1.2	-		
		34,293.3				37,215.1				65,567.6				131,829.6	

Table 8.--Aboveground ovendry biomass by species and stratum for the fir-birch community type of northeastern Minnesota

(In Kg/ha)

	Isabella Plantations								Cherokee-Frost Lake				BWCAW			
	1-5 n = 2				11-15 n = 1				33 n = 7				MATURE n = 22			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Tree																
Abies balsamea (L.) Mill.	2.3	-	21.5	-	130.0		1,061.6		256.9	139.5	2,168.6	1,194.5	2,385.3	427.0	18,805.5	3,362.4
Acer rubrum L.													15.2	9.2	545.4	337.1
Betula papyrifera Marsh.					1,117.2		27,228.5		1,107.9	157.5	37,923.8	6,858.2	1,479.9	333.1	34,537.8	7,737.6
Picea glauca (Moench) Voss.	45.1	-	350.9	-					218.0	126.2	1,554.6	972.2	1,004.4	253.6	9,640.4	2,685.5
Picea mariana (Mill.) B.S.P.					2,074.3		17,606.6		168.4	130.6	1,243.6	981.7	1,287.3	397.2	11,637.8	3,546.5
Pinus banksiana Lamb.	2.7	-	18.5	-	1,954.2		39,550.8		338.1	135.9	6,233.5	2,566.2	224.2	100.9	6,098.3	2,769.8
Pinus resinosa Ait.	10.6	9.4	83.2	74.0									24.6	18.6	346.1	256.1
Pinus strobus L.									3.0	2.0	51.0	33.2	317.3	163.3	6,649.0	3,443.6
Populus tremuloides Michx.	266.8	116.0	4,917.5	2,571.7	60.2		2,124.2		485.7	124.4	16,943.6	5,172.7	650.8	181.8	34,718.8	9,273.7
Sorbus americana Marsh.													1.3	1.1	14.9	12.5
Thuja occidentalis L.									17.1	-	109.7	-	1,388.0	477.6	12,828.3	4,665.6
Stratum total	327.5		5,391.6		5,335.9		87,571.7		2,595.1		66,228.4		8,778.3		135,822.3	
Sapling																
Abies balsamea (L.) Mill.									46.9	31.9	384.0	257.5	826.1	140.1	6,996.7	1,187.8
Acer rubrum L.													2.4	1.4	37.5	21.8
Betula papyrifera Marsh.									294.9	136.1	10,846.1	5,037.0	82.3	22.1	2,950.0	805.8
Picea glauca (Moench) Voss.									94.8	60.6	614.0	403.5	41.2	32.4	261.2	207.3
Picea mariana (Mill.) B.S.P.									204.6	151.2	1,192.3	907.1	151.4	58.8	892.9	344.8
Pinus banksiana Lamb.									19.9	13.4	169.9	116.1	.6	.5	3.2	2.4
Pinus strobus L.													6.4	6.0	113.9	106.2
Populus grandidentata Michx.													.2	-	6.9	-
Populus tremuloides Michx.									471.6	253.3	12,432.8	6,763.4	23.3	13.1	588.5	336.4
Sorbus americana Marsh.									11.9	9.3	175.3	145.1	4.3	2.3	43.5	23.1
Thuja occidentalis L.									4.5	3.4	14.8	11.2	329.5	157.7	1,609.3	748.8
Stratum total									1,149.1		25,829.2		1,467.7		13,503.6	

(Table 8 continued on next page)

(Table 8.--continued)

	Isabella Plantations								Cherokee-Frost Lake				BWCAW			
	1-5 n = 2				11-15 n = 1				33 n = 7				MATURE n = 22			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree seedling																
Abies balsamea (L.) Mill.									87.1	24.1	206.9	59.3	67.9	9.3	146.5	22.8
Acer rubrum L.									.6	-	18.1	-	2.3	1.4	44.9	29.1
Betula papyrifera Marsh.					0.5		1.5		7.3	2.3	185.2	64.1	1.2	.3	23.6	5.8
Fraxinus nigra Marsh.													<.1	-	.2	-
Picea glauca (Moench) Voss.									23.1	11.2	46.7	23.6	3.1	1.0	5.0	1.6
Picea mariana (Mill.) B.S.P.									33.2	13.1	68.0	27.6	8.3	4.1	15.0	7.6
Pinus banksiana Lamb.									.1	-	.5	-				
Pinus resinosa Ait.													.1	-	.4	-
Pinus strobus L.													1.0	.4	5.9	2.4
Populus tremuloides Michx.	154.5	-	897.6	-					4.0	1.4	22.4	8.4	5.9	1.6	33.6	9.4
Quercus rubra L.													.2	-	1.0	-
Sorbus americana Marsh.					3.0		28.6		1.7	.7	8.9	3.7	4.8	1.0	25.5	5.1
Thuja occidentalis L.									104.2	80.8	218.8	176.6	22.9	8.0	38.4	14.0
Stratum total	154.5		897.6		3.0		28.6		261.3		775.5		117.8		340.0	
Tall shrub																
Acer spicatum Lam.	.1	-	3.0	-	41.0		471.2		65.3	33.5	550.0	374.4	69.9	22.2	611.6	220.2
Alnus crispa (Ait.) Pursh.					107.5		1,040.4		17.0	13.6	155.4	114.1	1.1	.5	6.8	3.2
Alnus rugosa (DuRoi) Spreng.									.5	-	5.0	-	6.9	-	66.5	-
Amelanchier Medic. spp.					.3		1.6		.3	.3	3.4	3.3	.1	.1	1.5	1.1
Cornus rugosa Lam.									.6	-	1.3	-	1.9	1.4	10.1	7.4
Corylus cornuta Marsh.	.5	-	5.3	-	246.4		2,030.0		63.0	14.3	383.6	89.0	26.4	10.6	157.2	68.7
Lonicera canadensis Marsh.									.9	.5	2.8	1.7	1.7	.3	5.5	1.2
Lonicera hirsuta Eat.					1.7		4.2						.1	.1	.2	.2
Lonicera oblongifolia (Goldie) Hook.					.2		.7									
Lonicera villosa (Michx.) R.dS.									.1	-	.1	-	<.1	-	<.1	-
Prunus pensylvanica L.F.					6.8		67.2		30.1	12.3	338.0	137.4	<.1	<.1	<.1	<.1
Prunus virginiana L.					4.9		21.3		.1	-	.6	-	.1	-	.7	-
Salix bebbiana Sarg.									104.6	8.1	117.5	94.5	4.4	4.4	141.6	141.6
Salix L. spp.									22.4	-	728.4	-	.2	-	.7	-
Sambucus canadensis L.									<.1	-	<.1	-				
Sambucus L. spp.													3.2	-	40.4	-
Taxus canadensis Marsh.													5.2	5.1	11.8	11.7
Viburnum rafinesquianum Schult.													.1	-	.2	-
Stratum total	.6		8.3		408.8		3,636.6		305.0		2,286.2		121.4		1,054.9	

(Table 8 continued on next page)

(Table 8.--continued)

	Isabella Plantations								Cherokee-Frost Lake				BWCAW			
	1-5 n = 2				11-15 n = 1				33 n = 7				MATURE n = 22			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Low shrub																
Chimaphila umbellata (L.) Bart.							2.9				1.6	-			1.4	0.7
Diervilla Lonicera Mill.			50.4	21.1			40.2				11.7	5.3			9.2	2.3
Gaultheria hispidula (L.) Muhl.															.2	-
Gaultheria procumbens L.							2.9									
Ribes L. spp.											1.9	-			.2	-
Rosa acicularis Lindl.			3.3	3.1			32.1				4.8	2.0			1.7	.7
Rubus parviflorus Nutt.											2.8	-			4.3	2.3
Rubus pubescens Raf.			.3	-			4.2				14.1	9.1			3.2	1.0
Rubus strigosus Michx.			183.6	14.6			1.9				4.4	1.6			19.4	14.7
Vaccinium angustifolium Ait.							1.6				.3	-			2.1	.7
Vaccinium myrtilloides Michx.			.9	-			24.3				3.4	-			4.5	1.4
Stratum total			238.5				110.1				45.0				46.2	
Herb																
Actaea rubra (Ait.) Willd.									0.3	-			0.1	0.1		
Anaphalis margaritacea (L.) C.B. Clarke									1.1	0.5						
Anemone quinquefolia L.					<0.1				.1	-			.1	<.1		
Apocynum androsaemifolium L.									3.1	2.3			.4	.3		
Aralia nudicaulis L.					10.2				41.6	7.8			14.2	3.2		
Aster ciliolatus Lindl.									.6	.3			.1	-		
Aster macrophyllus L.	43.5	.2			12.1				159.4	31.3			51.5	9.3		
Aster L. spp.									.3	-						
Carex L. spp.									13.8	6.3			2.5	1.0		
Circaea alpina L.	<.1	-											.2	-		
Clintonia borealis (Ait.) Raf.	1.0	-			6.6				7.2	1.8			10.7	2.3		
Coptis groenlandica (Oeder) Fern.									.2	-			2.6	1.4		

(Table 8 continued on next page)

(Table 8.--continued)

	Isabella Plantations								Cherokee-Frost Lake				BWCAW			
	1-5				11-15				33				MATURE			
	n = 2				n = 1				n = 7				n = 22			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Cornus canadensis L.	3.0	-			26.6				43.6	10.2			23.4	4.9		
Cynoglossum boreale Fern.													.1	.1		
Epilobium angustifolium L.									8.4	3.1			.1	-		
Epigaea repens L.													.6	-		
Fragaria vesca L.	35.6	33.0							.1	-			3.7	1.1		
Fragaria virginiana Ouchesne.					.4											
Galium boreale L.													<.1	-		
Galium triflorum Michx.	<.1	-							1.4	.8			.3	.2		
Goodyera repens (L.) R. Br.									.2	-			.3	.1		
Goodyera tesselata Lodd.									2.4	1.5			<.1	-		
Grasses	254.3	31.0			46.7				28.7	7.7			15.8	3.7		
Habenaria orbiculata (Pursh) Torr.													.1	-		
Hieracium scabrum Michx.													.1	-		
Impatiens capensis Meerb.													.8	-		
Lactuca L. spp.	<.1	-														
Lathyrus ochroleucus Hook.	9.8	7.1											.3	.2		
Linnaea borealis L.					4.1				22.6	8.3			15.8	3.2		
Maianthemum canadense Desf.					.9				6.6	1.4			6.0	1.1		
Melampyrum lineare Desr.									.3	-			.1	.1		
Mitella nuda L.													1.4	.5		
Moneses uniflora (L.) Gray													.1	.1		
Petasites palmatus (Ait.) Gray									.5	.3						
Petasites vitifolius Rydb.													.4	.3		
Polygala paucifolia Willd.					<.1											
Polygonum cilinode Michx.													.2	-		
Pyrola asarifolia Michx.													<.1	-		
Pyrola elliptica Nutt.									.1	-			.1	<.1		
Pyrola rotundifolia L.									.1	-			.1	.1		
Pyrola secunda L.									.1	-			.7	.2		
Pyrola virens Schweigg.									.1	-			.2	.1		
Streptopus roseus Michx.									2.2	.9			.1	.3		
Taraxacum spp.									.1	-						
Thalictrum dioicum L.													.1	-		
Trientalis borealis Raf.					<.1				7.3	6.0			.3	.1		
Uvularia sessilifolia L.													<.1	-		
Vicia americana Muhl.	<.1												.2	.1		
Viola L. spp.					.4				1.4	.4			1.0	.2		
Waldsteinia fragarioides (Michx.) Tratt.									.1	-			<.1	-		
Stratum total	347.3				108.1				353.7				154.9			

(Table 8 continued on next page)

(Table 8.--continued)

	Isabella Plantations								Cherokee-Frost Lake				BWCAW			
	1-5 n = 2				11-15 n = 1				33 n = 7				MATURE n = 22			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Fern and fern allies																
Athyrium filix-femina (L.) Roth.													0.1	-		
Botrychium virginianum (L.) Sw.													<.1	-		
Dryopteris spinulosa (O.F. Muell.) Watt									2.2	2.0			.2	0.2		
Equisetum L. spp.									.3	.2			.1	-		
Gymnocarpium Dryopteris (L.) Newm.									3.0	-			.1	.1		
Lycopodium annotinum L.													3.8	1.9		
Lycopodium clavatum L.					<.1				3.9	1.4			4.0	1.1		
Lycopodium complanatum L.					<.1								.2	.1		
Lycopodium lucidulum Michx.													.1	-		
Lycopodium obscurum L.					<.1				3.4	1.4			4.0	2.0		
Pteridium aquilinum (L.) Kuhn.	114.1	39.1			14.3								2.6	1.1		
Stratum total	114.1				14.4				12.8				15.3			
Moss																
Calliergonella schreberi (Willd., BR. & Sch.) Grout									143.0	25.2			555.7	99.9		
Dicranum Hedw. spp.									41.1	12.0			43.1	11.4		
Hylocomium splendens (Hedw.) B.S.G.									1.0	.7			16.9	8.7		
Hypnum crista-castrensis Hedw.									.6	.4			14.6	4.9		
Polytrichum Hedw. spp.									44.2	20.6			13.2	7.0		
Sphagnum L. spp.													6.4	-		
All other mosses									165.5	42.3			469.5	57.2		
Stratum total									395.4				1,119.4			
Lichen																
Cladonia rangiferina (L.) Web.									18.9	10.0			3.4	3.0		
Cladonia sylvatica (L.) Hoffm.									1.5	1.0			7.9	6.1		
All other lichens									25.9	11.0			14.2	4.9		
Stratum total									46.3				25.5			
Community total			6,997.4				91,469.5				95,972.5				152,082.1	

Table 9.--Aboveground ovendry biomass by species and stratum for the maple-aspen-birch community type of northeastern Minnesota

(In Kg/ha)

	BWCAW MATURE (n = 20)			
	Foliage		Total	
Stratum/Species	$\bar{X}$	SE	$\bar{X}$	SE
Tree				
Abies balsamea (L.) Mill.	278.8	89.6	2,165.4	694.1
Acer rubrum L.	471.5	90.0	18,646.1	3,714.4
Betula papyrifera Marsh.	906.0	160.2	22,950.0	3,986.2
Fraxinus nigra Marsh.	2.3	-	53.0	-
Picea glauca (Moench) Voss.	200.2	105.2	1,833.1	972.2
Picea mariana (Mill.) B.S.P.	103.1	36.7	948.2	344.5
Pinus banksiana Lamb.	179.7	75.1	4,336.7	1,717.4
Pinus resinosa Ait.	890.7	449.1	12,677.8	6,378.2
Pinus strobus L.	949.2	511.1	21,823.7	11,554.8
Populus grandidentata Michx.	94.9	38.9	6,610.4	2,811.7
Populus tremuloides Michx.	1,057.7	151.0	56,737.4	8,429.8
Quercus rubra L.	77.6	44.2	1,560.8	921.2
Sorbus americana Marsh.	2.3	-	26.4	-
Stratum total	5,214.0		15,0369.0	
Sapling				
Abies balsamea (L.) Mill.	136.2	63.3	1,151.5	533.6
Acer rubrum L.	247.4	58.1	4,568.0	1,097.3
Betula papyrifera Marsh.	152.6	25.6	5,495.4	908.3
Fraxinus nigra Marsh.	.9	.7	11.4	8.1
Picea glauca (Moench) Voss.	21.6	13.6	137.8	87.0
Picea mariana (Mill.) B.S.P.	22.3	15.3	136.5	99.2
Pinus resinosa Ait.	1.2	.8	11.8	7.5
Pinus strobus L.	.6	.5	11.6	8.4
Populus grandidentata Michx.	5.7	2.1	235.8	84.4
Populus tremuloides Michx.	57.8	15.0	1,499.7	390.2
Quercus rubra L.	9.7	5.8	96.7	57.9
Sorbus americana Marsh.	5.4	2.6	56.3	27.4
Stratum total	661.4		13,412.5	
Tree seedling				
Abies balsamea (L.) Mill.	30.6	12.2	69.5	28.5
Acer rubrum L.	12.0	2.0	169.4	30.2
Betula papyrifera Marsh.	.9	.2	20.4	5.3
Fraxinus nigra Marsh.	1.0	.6	5.5	3.6
Picea glauca (Moench) Voss.	5.4	2.9	10.1	5.7
Picea mariana (Mill.) B.S.P.	.6	.4	1.0	.6
Pinus Resinosa Ait.	.1	.1	.5	.3
Pinus strobus L.	2.1	.8	13.1	4.5
Populus grandidentata Michx.	.2	.2	1.3	1.0
Populus tremuloides Michx.	8.7	1.6	51.3	10.9
Quercus rubra L.	7.9	3.4	37.7	17.2
Sorbus americana Marsh.	.8	.4	4.0	1.8
Thuja occidentalis L.	.2	-	.4	-
Stratum total	70.5		384.2	
Tall shrub				
Acer spicatum Lam.	49.9	15.6	397.9	139.5
Alnus crispa (Ait.) Pursh.	38.0	19.4	286.2	147.3
Amelanchier Medic. spp.	11.4	4.4	112.7	41.5
Cornus rugosa Lam.	9.3	5.8	47.3	36.3
Lonicera canadensis Marsh.	1.1	.5	5.6	3.4
Lonicera villosa (Michx.) R.dS.	<.1	-	<.1	-
Prunus pensylvanica L.F.	<.1	-	<.1	-
Prunus virginiana L.	.1	.1	.5	.5
Salix bebbiana Sarg.	13.7	13.2	532.1	530.0
Salix L. spp.	<.1	-	<.1	-
Viburnum reginesquianum Schult.	.8	.6	2.8	2.1
Stratum total	331.0		2,644.7	

(Table 9 continued on next page)

(Table 9.--continued)

	BWCAW MATURE (n = 20)			
	Foliage		Total	
Stratum/Species	X̄	SE	X̄	SE
Low shrub				
Arctostaphylos Uva-ursi (L.) Spreng.			0.4	-
Chimaphila umbellata (L.) Bart.			.2	0.1
Comptonia peregrina B.&B. Small. Rydb.			1.4	1.0
Diervilla Lonicera Mill.			11.4	2.2
Gaultheria procumbens L.			.8	.4
Rosa acicularis Lindl.			.1	-
Rubus pubescens Raf.			1.4	.8
Rubus strigosus Michx.			1.2	.4
Vaccinium angustifolium Ait.			9.0	2.9
Vaccinium myrtilloides Michx.			8.3	5.9
Stratum total			34.2	
Herb				
Anaphalis margaritacea (L.) C.B. Clarke	0.1	-		
Anemone quinquefolia L.	.1	0.1		
Apocynum androsaemifolium L.	1.0	.8		
Aralia nudicaulis L.	27.4	4.6		
Aster ciliolatus Lindl.	.2	-		
Aster macrophyllus L.	132.7	20.0		
Carex L. spp.	10.7	5.5		
Clintonia borealis (Ait.) Raf.	11.6	2.9		
Coptis groenlandica (Oeder) Fern.	1.7	.8		
Cornus canadensis L.	8.9	3.6		
Epilobium angustifolium L.	.2	-		
Fragaria vesca L.	2.3	1.2		
Galium triflorum Michx.	.1	<.1		
Geranium bicknellii Britt.	.2	.1		
Goodyera repens (L.) R. Br.	.2	.1		
Goodyera tesselata Lodd.	.1	.1		
Grasses	26.9	5.3		
Impatiens capensis Meerb.	.3	.2		
Lathyrus ochroleucus Hook.	.7	.3		
Lathyrus venosus Muhl.	.1	-		
Linnaea borealis L.	4.1	1.6		
Maianthemum canadense Desf.	8.6	1.2		
Melampyrum lineare Desr.	.5	.3		
Mitella nuda L.	.1	-		
Monotropa uniflora L.	<.1	-		
Petasites vitifolius Rydb.	.3	-		
Pyrola rotundifolia L.	<.1	-		
Pyrola secunda L.	.1	.1		
Streptopus roseus Michx.	2.0	.5		
Trientalis borealis Raf.	.6	.1		
Uvularia sessilifolia L.	.2	.1		
Viola L. spp.	.5	.1		
Stratum total	242.6			
Fern and fern allies				
Dryopteris Phegopteris L.	.5	-		
Dryopteris spinulosa (O.F. Muell.) Watt	1.2	1.1		
Gymnocarpium Dryopteris (L.) Newm.	.3	-		
Lycopodium annotinum L.	3.1	1.4		
Lycopodium clavatum L.	4.2	1.3		
Lycopodium complanatum L.	1.9	1.9		
Lycopodium obscurum L.	9.7	2.2		
Osmunda claytoniana L.	2.0	1.8		
Polypodium virginianum L.	.3	-		
Pteridium aquilinum (L.) Kuhn.	51.7	13.4		
Stratum total	74.9			
Moss				
Calliergonella schreberi (Willd., BR. & Sch.) Grout	84.3	21.8		
Dicranum Hedw. spp.	27.0	14.1		
Hypnum crista-castrensis Hedw.	.7	-		
Polytrichum Hedw. spp.	11.4	8.1		
All other mosses	304.4	48.4		
Stratum total	427.8			
Lichen				
Cladonia mitis Sandst.	.5	-		
Cladonia rangiferina (L.) Web.	7.4	-		
Cladonia sylvatica (L.) Hoffm.	.5	-		
Peltigera aphthosa (L.) Willd.	1.0	.7		
All other lichens	25.7	6.8		
Stratum total	35.1			
Community total			167,625.0	

Table 10.--Aboveground ovendry biomass by species and stratum for the maple-aspen-birch-fir community type of northeastern Minnesota

(In Kg/ha)

	BWCAW MATURE (n = 19)			
	Foliage		Total	
Stratum/Species	X̄	SE	X̄	SE
Tree				
Abies balsamea (L.) Mill.	1,402.8	376.3	11,054.6	2,987.3
Acer rubrum L.	425.8	103.5	16,099.1	3,957.9
Betula papyrifera Marsh.	1,084.3	303.8	24,927.6	7,103.9
Picea glauca (Moench) Voss.	289.8	75.7	2,637.4	714.8
Picea mariana (Mill.) B.S.P.	594.3	176.4	5,465.3	1,696.8
Pinus banksiana Lamb.	174.6	104.6	4,530.3	2,922.9
Pinus resinosa Ait.	320.6	224.6	5,051.0	3,515.2
Pinus strobus L.	982.7	423.6	23,497.5	10,136.9
Populus grandidentata Michx.	34.3	20.1	2,395.0	1,382.9
Populus tremuloides Michx.	1,296.6	301.2	73,057.3	18,290.4
Thuja occidentalis L.	90.4	88.8	1,408.9	1,392.4
Stratum total	6,696.2		170,124.0	
Sapling				
Abies balsamea (L.) Mill.	567.8	149.3	4,783.8	1,255.3
Acer rubrum L.	206.1	44.0	3,966.0	832.0
Betula papyrifera Marsh.	75.7	30.4	2,728.5	1,085.7
Picea glauca (Moench) Voss.	41.2	22.8	272.2	153.9
Picea mariana (Mill.) B.S.P.	129.5	53.3	756.2	296.7
Pinus banksiana Lamb.	.6	-	4.8	-
Pinus resinosa Ait.	.6	.4	6.1	4.2
Pinus strobus L.	.5	.4	9.4	7.8
Populus grandidentata Michx.	.4	.4	15.8	15.3
Populus tremuloides Michx.	37.2	12.7	1,014.5	352.2
Quercus rubra L.	.9	-	5.8	-
Sorbus americana Marsh.	24.9	18.8	246.5	184.2
Stratum total	1,085.4		13,809.6	
Tree seedling				
Abies balsamea (L.) Mill.	50.3	6.9	114.1	16.2
Acer rubrum L.	13.2	2.9	203.2	55.0
Betula papyrifera Marsh.	1.3	.2	27.6	5.6
Fraxinus nigra Marsh.	.1	-	.5	-
Picea glauca (Moench) Voss.	3.3	1.4	5.6	2.3
Picea mariana (Mill.) B.S.P.	4.6	2.6	7.9	4.4
Pinus resinosa Ait.	<.1	-	.2	-
Pinus strobus L.	1.5	.6	10.2	4.0
Populus grandidentata Michx.	.3	-	1.6	-
Populus tremuloides Michx.	10.2	2.1	57.0	12.4
Quercus rubra L.	3.4	3.1	18.5	16.8
Sorbus americana Marsh.	6.2	1.7	33.9	9.5
Thuja occidentalis L.	.1	-	.2	-
Tilia americana L.	<.1	-	.2	-
Stratum total	94.6		480.7	
Tall shrub				
Acer spicatum Lam.	96.8	29.5	867.6	313.3
Alnus crispa (Ait.) Pursh.	.6	.4	4.8	4.4
Alnus rugosa (DuRoi) Spreng.	<.1	-	<.1	-
Amelanchier Medic. spp.	16.4	14.9	127.2	110.2
Cornus rugosa Lam.	.6	.4	2.8	1.9
Corylus cornuta Marsh.	95.0	25.3	565.6	162.8
Lonicera canadensis Marsh.	.9	.3	3.5	1.3
Lonicera villosa (Michx.) R.dS.	<.1	<.1	.1	<.1
Prunus pensylvanica L.F.	13.4	11.7	75.9	65.1
Prunus virginiana L.	.1	.1	1.3	1.3
Salix bebbiana Sarg.	<.1	-	<.1	-
Salix L. spp.	<.1	-	<.1	-
Viburnum rafinesquianum Schult.	1.9	1.9	18.9	18.8
Stratum total	225.8		1,667.8	

(Table 10 continued on next page)

(Table 10.--continued)

	BWCAW MATURE (n = 19)			
	Foliage		Total	
Stratum/species	$\bar{X}$	SE	$\bar{X}$	SE
Low shrub				
Chimaphila umbellata (L.) Bart.			0.6	0.3
Diervilla Lonicera Mill.			6.4	2.1
Gaultheria hispidula (L.) Muhl.			.7	.5
Gaultheria procumbens L.			3.5	1.8
Ledum groenlandicum Oeder.			<.1	-
Ribes L. spp.			.1	-
Rosa acicularis Lindl.			.8	.7
Rubus pubescens Raf.			3.3	1.8
Rubus strigosus Michx.			11.1	7.1
Vaccinium angustifolium Ait.			10.6	2.8
Vaccinium myrtilloides Michx.			4.9	2.2
Stratum total			42.1	
Herb				
Anemone quinquefolia L.	0.2	0.1		
Aralia nudicaulis L.	22.6	4.7		
Aster ciliolatus Lindl.	.1	-		
Aster macrophyllus L.	83.2	13.0		
Carex L. spp.	5.2	2.0		
Circaea alpina L.	.2	-		
Clintonia borealis (Ait.) Raf.	17.0	3.6		
Coptis groenlandica (Oeder) Fern.	2.6	.8		
Cornus canadensis L.	20.8	3.6		
Epilobium angustifolium L.	.1	-		
Epigaea repens L.	.1	-		
Fragaria vesca L.	1.1	.7		
Fragaria virginiana Duchesne.	.2	.2		
Galium triflorum Michx.	.5	.2		
Goodyera repens (L.) R. Br.	.1	.1		
Goodyera tesselata Lodd.	.1	.1		
Grasses	19.4	3.2		
Habenaria orbiculata (Pursh) Torr.	.2	-		
Habenaria spp.	<.1	-		
Lathyrus ochroleucus Hook.	.3	-		
Linnaea borealis L.	4.0	1.1		
Maianthemum canadense Desf.	12.4	1.2		
Melampyrum lineare Desr.	.6	.2		
Mitella nuda L.	.3	-		
Petasites vitifolius Rydb.	.4	.3		
Polygonum cilinode Michx.	.7	.4		
Pyrola secunda L.	.2	.1		
Pyrola virens Schweigg.	<.1	-		
Solidago L. spp.	.2	.1		
Streptopus roseus Michx.	2.2	.7		
Trientalis borealis Raf.	.8	.1		
Trifolium repens L.	<.1	-		
Viola L. spp.	.9	.2		
Waldsteinia fragarioides (Michx.) Tratt.	.1			
Stratum total	196.9			
Fern and fern allies				
Athyrium filix-femina (L.) Roth.	1.8	-		
Dryopteris spinulosa (D.F. Muell.) Watt	.4	.3		
Equisetum L. spp.	<.1	-		
Gymnocarpium Dryopteris (L.) Newm.	.2	.1		
Lycopodium annotinum L.	5.0	1.6		
Lycopodium clavatum L.	11.8	5.6		
Lycopodium complanatum L.	.6	.4		
Lycopodium lucidulum Michx.	2.9	-		
Lycopodium obscurum L.	12.4	2.6		
Osmunda claytoniana L.	1.9	-		
Polypodium virginianum L.	.3	.2		
Pteridium aquilinum (L.) Kuhn.	34.3	9.5		
Stratum total	71.7			
Moss				
Calliergonella schreberi (Willd., BR. & Sch.) Grout	207.6	50.8		
Dicranum Hedw. spp.	36.6	13.2		
Hylocomium splendens (Hedw.) B.S.G.	.2	-		
Hypnum crista-castrensis Hedw.	2.2	2.0		
Polytrichum Hedw. spp.	9.3	2.7		
Sphagnum L. spp.	2.0	-		
All other mosses	287.0	42.9		
Stratum total	544.9			
Lichen				
Cladonia rangiferina (L.) Web.	10.0	4.6		
Cladonia sylvatica (L.) Hoffm.	7.5	5.8		
Peltigera aphthosa (L.) Willd.	.7	-		
All other lichens	17.0	7.1		
Stratum total	35.2			
Community total			186,972.9	

Table 11.--Aboveground ovendry biomass by species and stratum for the jack pine-oak community type of northeastern Minnesota

(In Kg/ha)

	Little Sioux Fire											
	1 n = 1				3 n = 1				5 n = 1			
	Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree												
Abies balsamea (L.) Mill.												
Acer rubrum L.												
Betula papyrifera Marsh.												
Picea glauca (Moench) Voss.												
Picea mariana (Mill.) B.S.P.												
Pinus banksiana Lamb.												
Pinus resinosa Ait.												
Pinus strobus L.												
Populus grandidentata Michx.												
Populus tremuloides Michx.												
Quercus rubra L.												
Stratum total												
Sapling												
Abies balsamea (L.) Mill.												
Acer rubrum L.												
Betula papyrifera Marsh.												
Picea glauca (Moench) Voss.												
Picea mariana (Mill.) B.S.P.												
Pinus banksiana Lamb.												
Pinus resinosa Ait.												
Pinus strobus L.												
Populus grandidentata Michx.												
Populus tremuloides Michx.												
Quercus rubra L.												
Stratum total												

	Little Sioux Fire											
	1 n = 1				3 n = 1				5 n = 1			
	Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree seedling												
Abies balsamea (L.) Mill.												
Acer rubrum L.			21.4		61.7		130.4		269.0		811.9	
Betula papyrifera Marsh.									421.0		1,883.8	
Picea mariana (Mill.) B.S.P.												
Pinus banksiana Lamb.			1.4		62.2		91.0		904.3		1,737.8	
Pinus strobus L.												
Populus balsamifera L.												
Populus grandidentata Michx.					5.2		11.2		25.8		70.3	
Populus tremuloides Michx.			1.5		84.0		250.2		51.8		215.0	
Quercus rubra L.							.3					
Sorbus americana Marsh.												
Stratum total			24.3		213.1		483.1		1,671.9		4,718.8	
Tall shrub												
Alnus crispa (Ait.) Pursh.												
Amelanchier Medic. spp.			13.7		20.6		43.6		302.8		1,134.0	
Cornus rugosa Lam.												
Corylus cornuta Marsh.			80.9									
Lonicera canadensis Marsh.									.3		.7	
Lonicera oblongifolia (Goldie) Hook.												
Lonicera villosa (Michx.) R.dS.												
Prunus pensylvanica L.F.			3.7		32.1		78.0		518.1		1,675.0	
Prunus virginiana L.												
Salix bebbiana Sarg.												
Salix L. spp.			90.2						147.3		605.0	
Spiraea L. spp.												
Stratum total			188.5		52.7		121.6		968.5		3,414.7	

Isabella Plantations												BWCAW			
11-15 n = 2				21-25 n = 2				26-30 n = 1				MATURE n = 6			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
50.2	-	384.9	-	1,281.0	-	9,900.6	-					10.8	-	87.3	-
												9.1	5.9	252.4	163.2
102.4	50.6	2,497.4	861.7	93.8	17.9	2,564.2	192.5					22.3	15.2	596.8	399.4
390.6	177.1	3,042.4	1,337.4	838.5	817.9	7,218.2	7,086.4								
459.8	-	3,942.2	-	548.9	94.6	4,357.7	1,443.3	47.7		237.6		583.4	447.4	5,015.9	3,858.0
2,432.1	1,601.1	24,572.3	15,871.4	2,151.3	-	30,665.5	-	2,645.7		37,501.9		5,230.2	783.3	95,630.2	13,837.6
507.8	-	4,886.9	-	2,256.0	763.8	24,902.4	8,571.5	3,556.6		40,409.6		423.0	399.0	6,363.2	6,021.9
				177.5	-	3,677.2	-					286.5	-	6,263.0	-
												18.8	15.8	1,283.7	1,114.1
				3.0	.6	73.9	29.1	577.5		25,657.7		30.1	11.1	1,292.2	559.1
												2.4	-	41.6	-
3,942.9		39,326.1		7,350.0		83,359.7		6,827.5		103,806.8		6,616.6		116,826.3	
												3.0	2.4	26.0	20.0
												18.0	15.7	353.0	319.0
												16.8	6.6	644.9	247.0
												12.7	12.2	83.1	80.6
												215.2	108.8	1,215.1	623.3
												573.5	341.7	5,730.6	3.326.6
												1.0	-	8.4	-
												2.4	1.3	41.9	22.3
												.3	-	11.3	-
												.8	.7	20.5	18.3
												10.9	4.6	98.4	42.0
												854.6		8,233.2	

Isabella Plantations												BWCAW			
11-15 n = 2				21-25 n = 2				26-30 n = 1				MATURE n = 6			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
												3.2	2.1	7.3	4.8
				<0.1	-	<0.1	-					1.9	.5	35.0	9.2
				2.6	2.5	57.8	57.6					.6	.4	15.5	10.6
												36.6	22.6	68.3	42.9
												.1	-	.6	-
												14.4	13.8	126.3	121.7
				<.1	-	.6	-								
												2.4	1.4	16.0	9.4
												7.2	3.6	38.6	19.8
												.1	-	.7	-
				2.7		58.5						66.5		308.3	
77.0	-	669.8	-	74.9	-	779.9	-	194.8		1,905.7		1.0	-	4.0	-
13.2	11.1	86.6	76.8	17.2	4.8	149.5	64.5	7.3		47.6		.6	.4	12.0	5.7
.2	-	.6	-					16.2		81.4					
76.0	69.1	693.2	631.2	124.6	-	1,233.7	-	178.1		1,494.9		18.2	7.0	95.7	43.4
4.0	3.0	30.6	22.3	3.3	2.7	22.1	17.5								
.3	-	1.1	-	<.1	-	<.1	-	2.6		10.6					
.6	-	4.0	-												
.8	.4	9.2	4.6	8.0	3.3	78.6	29.8								
				7.6	-	52.0	-					<.1	<.1	.1	.1
												4.8	4.7	73.8	73.7
				.5	-	1.6	-	8.6		37.5		5.1	-	40.5	-
												.3	-	.6	-
172.1		1,495.1		236.2		2,317.5		407.6		3,577.7		30.1		226.7	

(Table 11.--continued)

	Little Sioux Fire											
	1 n = 1				3 n = 1				5 n = 1			
	Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Low shrub												
Chimaphila umbellata (L.) Bart.												
Comptonia peregrina B.&B. Small. Rydb.			40.5				799.4				1,377.0	
Diervilla Lonicera Mill.			4.8				3.6				28.4	
Gaultheria hispidula (L.) Muhl.												
Gaultheria procumbens L.			8.6				52.2				44.5	
Ledum groenlandicum Oeder.												
Ribes L. spp.												
Rosa blanda Ait.												
Rosa acicularis Lindl.												
Rubus pubescens Raf.												
Rubus strigosus Michx.												
Vaccinium angustifolium Ait.			46.2				290.0				54.5	
Vaccinium myrtilloides Michx.			15.0				8.7				156.6	
Stratum total			115.1				1,153.9				1,661.0	
Herb												
Anemone quinquefolia L.												
Apocynum androsaemifolium L.												
Aralia hispida Vent.	1.1				203.3				103.7			
Aralia nudicaulis L.	12.7				49.8				24.1			
Aster macrophyllus L.	333.3				194.1				135.0			
Carex L. spp.	14.4				24.7							
Clintonia borealis (Ait.) Raf.	1.6											
Coptis groenlandica (Oeder) Fern.												
Cornus canadensis L.	.1				6.8							
Corydalis sempervirens (L.) Pers.	1.9											
Herb												
Epilobium angustifolium L.									7.7			
Epigaea repens L.												
Fragaria vesca L.												
Fragaria virginiana Duchesne.												
Geranium bicknellii	0.3											
Goodyera repens (L.) R. Br.												
Goodyera tesselata Lodd.												
Grasses					251.7				46.0			
Hieracium L. spp.												
Lathyrus ochroleucus Hook.												
Linnaea borealis L.												
Maianthemum canadense Desf.	3.9				14.0				13.6			
Melampyrum lineare Oesr.					1.6							
Polygala paucifolia Willd.												
Polygonum cilinode Michx.	2.5				14.4				.7			
Pyrola rotundifolia L.												
Pyrola secunda L.												
Pyrola virens Schweigg.												
Solidago L. spp.												
Streptopus roseus Michx.												
Trientalis borealis Raf.												
Viola L. spp.	<.1											
Stratum total	371.9				760.4				330.8			
Fern and fern allies												
Lycopodium clavatum L.												
Lycopodium complanatum L.												
Lycopodium obscurum L.	.8											
Pteridium aquilinum (L.) Kuhn.	301.7				961.5				264.8			
Stratum total	302.5				961.5				264.8			
Moss												
Calliergonella schreberi (Willd., BR. & Sch.) Grout												
Dicranum Hedw. spp.												
Polytrichum Hedw. spp.	0.1				5.2				33.2			
All other mosses												
Stratum total	.1				5.2				33.2			
Lichen												
Cladonia mitis Sandst.												
Cladonia rangiferina (L.) Web.												
All other lichens												
Stratum total												
Unidentified plants	.1				<.1							
Community total			1,002.5				3,485.8				10,423.3	

Isabella Plantations												BWCAW			
11-15 n = 2				21-25 n = 2				26-30 n = 1				MATURE n = 6			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
		2.9	-			1.2	-							1.8	-
		61.1	-							21.6				2.7	1.8
		68.9	61.1			20.4	17.1			103.2				33.3	14.0
						3.7	-							3.1	1.6
		69.2	33.3			66.0	32.5			29.8				67.6	10.9
						17.6	-								
										1.1					
		9.2	-												
		60.5	43.4			20.0	6.6			29.4				1.8	1.2
		.3	.3			.5	.5			.8					
		19.4	1.6			4.1	.9			20.0					
		82.0	46.1			12.3	1.1			28.1				198.4	33.6
		89.1	32.3			74.9	57.0							14.5	8.4
		462.6				220.7				234.0				323.2	
7.5	-			<0.1	-			<0.1				<0.1	-		
												1.0	0.7		
1.8	1.7			.7	-			7.0				5.7	2.0		
76.0	38.0			17.9	14.1			106.3				68.5	26.1		
12.6	10.7			13.3	.1			1.4				1.3	.7		
				<.1	-			<.1							
33.8	17.0			14.9	12.2			.2				19.5	17.8		

Isabella Plantations												BWCAW			
11-15 n = 2				21-25 n = 2				26-30 n = 1				MATURE n = 6			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												0.7	-		
				1.3	-							.3	-		
5.4	-			.4	-			9.8							
												.2	-		
												.2	-		
133.2	54.1			77.4	32.6			57.3				44.2	12.8		
								<.1							
2.5	-														
8.6	-			7.0	2.0			25.4				17.5	10.0		
8.4	1.5			1.5	1.2			9.1				12.9	2.1		
<.1	-											5.4	3.5		
<.1	0			<.1	-			<.1							
2.7	-			1.1	-			3.4							
2.7	-			.1	-			5.7							
1.1	-			1.1	-										
				<.1	-			<.1							
				<.1	-										
								<.1				.1	.1		
				.4	-			.2							
296.4				137.2				225.9				177.6			
<.1	-							2.7				.2	-		
				<.1	-			<.1							
<.1	-											.3	.2		
57.9	41.2			16.7	0			117.7				90.0	48.9		
58.0				16.8				120.5				90.5	18.4		

Isabella Plantations												BWCAW			
11-15 n = 2				21-25 n = 2				26-30 n = 1				MATURE n = 6			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												672.1	232.3		
												254.9	47.8		
												74.2	49.5		
												137.2	65.5		
												1,138.4			
												282.2	209.7		
												247.8	100.6		
												116.2	70.7		
												646.2	78.1		
		41,638.2				86,110.4				107,964.9				127,970.4	

Table 12.--Aboveground ovendry biomass by species and stratum for the maple-oak community type of northeastern Minnesota

(In Kg/ha)

	BWCAW MATURE (n = 4)			
	Foliage		Total	
Stratum/species	$\overline{X}$	SE	$\overline{X}$	SE
Tree				
Abies balsamea (L.) Mill.	1,087.0	986.8	8,558.0	7,755.5
Acer rubrum L.	515.8	304.9	17,127.7	10,869.8
Betula papyrifera Marsh.	141.7	90.9	3,798.5	2,455.5
Picea glauca (Moench) Voss.	172.6	-	1,444.0	-
Picea mariana (Mill.) B.S.P.	66.9	-	546.3	-
Pinus banksiana Lamb.	89.8	-	1,944.1	-
Pinus resinosa Ait.	1,839.8	1,170.2	26,246.1	16,966.7
Pinus strobus L.	327.0	211.5	6,993.6	4,472.1
Populus grandidentata Michx.	89.6	65.9	5,396.8	3,832.4
Populus tremuloides Michx.	547.8	236.9	25,291.7	11,520.3
Quercus rubra L.	1,726.0	930.6	34,403.6	16,677.6
Stratum total	6,604.0		131,750.4	
Sapling				
Abies balsamea (L.) Mill.	410.9	265.3	3,436.3	2,218.7
Acer rubrum L.	373.4	29.0	6,715.1	524.9
Betula papyrifera Marsh.	32.4	18.7	1,142.9	639.5
Picea glauca (Moench) Voss.	33.1	-	226.8	-
Pinus banksiana Lamb.	14.8	-	162.9	-
Pinus resinosa Ait.	1.7	1.5	15.9	14.3
Pinus strobus L.	14.6	-	260.4	-
Populus grandidentata Michx.	2.7	-	125.2	-
Populus tremuloides Michx.	5.2	3.2	147.5	90.3
Quercus rubra L.	543.2	262.2	5,732.0	2,833.1
Sorbus americana Marsh.	2.9	-	27.5	-
Stratum total	1,434.9		17,992.5	
Tree seedling				
Abies balsamea (L.) Mill.	28.4	11.9	61.5	27.3
Acer rubrum L.	12.3	3.0	124.8	37.3
Betula papyrifera Marsh.	.6	.4	15.5	11.3
Picea glauca (Moench) Voss.	.8	.8	1.2	-
Pinus banksiana Lamb.	.1	-	.9	-
Pinus resinosa Ait.	2.5	-	21.2	-
Pinus strobus L.	4.2	2.9	30.4	22.5
Populus grandidentata Michx.	.5	-	2.8	-
Populus tremuloides Michx.	5.1	3.2	26.7	16.3
Quercus rubra L.	49.6	19.4	280.8	124.9
Sorbus americana Marsh.	3.5	2.1	21.6	13.8
Tilia americana L.	.2	-	.9	-
Stratum total	107.8		588.3	
Tall shrub				
Acer spicatum Lam.	.8	-	1.4	-
Amelanchier Medic. spp.	113.1	109.7	824.2	773.3
Cornus rugosa Lam.	.9	-	1.7	-
Corylus cornuta Marsh.	82.5	23.1	406.0	117.6
Lonicera canadensis Marsh.	1.3	-	4.2	-
Prunus pensylvanica L.F.	<.1	-	.1	-
Salix bebbiana Sarg.	.2	.2	.3	.3
Viburnum rafinesquianum Schult.	.3	-	.7	-
Stratum total	199.2		1,238.6	

(Table 12 continued on next page)

(Table 12.--continued)

	BWCAW MATURE (n = 4)			
	Foliage		Total	
Stratum/species	$\bar{X}$	SE	$\bar{X}$	SE
Low shrub				
Comptonia peregrina B.&B. Small. Rydb.			4.0	2.9
Diervilla Lonicera Mill.			4.2	-
Gaultheria procumbens L.			24.3	9.7
Ribes triste Pall.			<.1	-
Rosa acicularis Lindl.			1.1	.6
Rubus pubescens Raf.			.4	-
Vaccinium angustifolium Ait.			66.1	42.7
Vaccinium myrtilloides Michx.			16.4	6.6
Stratum total			116.6	
Herb				
Anemone quinquefolia L.	<0.1	-		
Aralia nudicaulis L.	15.5	6.6		
Aster ciliolatus Lindl.	.3	-		
Aster macrophyllus L.	74.9	21.6		
Carex L. spp.	7.3	2.1		
Clintonia borealis (Ait.) Raf	5.4	1.3		
Coptis groenlandica (Oeder) Fern	.4	-		
Cornus canadensis L.	5.7	1.6		
Epigaea repens L.	4.8	-		
Fragaria vesca L.	.4	-		
Galium triflorum Michx.	<.1	-		
Goodyera repens (L.) R. Br.	.2	-		
Grasses	30.6	5.4		
Lathyrus ochroleucus Hook.	.4	-		
Maianthemum canadense Desf.	12.0	2.4		
Melampyrum lineare Desr.	5.5	2.6		
Mitella nuda L.	.2	-		
Monotropa uniflora L.	.1	.1		
Pyrola secunda L.	.1	.1		
Streptopus roseus Michx.	1.1	.6		
Trientalis borealis Raf.	.6	.3		
Uvularia sessilifolia L.	.1	.1		
Viola L. spp.	.2	-		
Stratum total	165.9			
Fern and fern allies				
Lycopodium annotinum L.	1.6	1.1		
Lycopodium clavatum L.	2.0	1.8		
Lycopodium obscurum L.	1.7	1.2		
Pteridium aquilinum (L.) Kuhn.	37.7	9.2		
Stratum total	43.0			
Moss				
Calliergonella schreberi (Willd., BR. & Sch.) Grout	31.8	23.4		
Dicranum Hedw. spp.	43.3	18.3		
Polytrichum Hedw. spp.	18.2	10.3		
All other mosses	194.6	50.5		
Stratum total	287.9			
Lichen				
Cladonia rangiferina (L.) Web.	5.3	3.7		
All other lichens	17.2	3.9		
Stratum total	22.5			
Community total			152,205.7	

Table 13.--Aboveground ovendry biomass by species and stratum for the red pine community type of northeastern Minnesota

	(In Kg/ha)			
	BWCAW			
	MATURE (n = 6)			
	Foliage		Total	
Stratum/species	$\overline{X}$	SE	$\overline{X}$	SE
Tree				
Abies balsamea (L.) Mill.	31.9	17.4	257.6	141.6
Acer rubrum L.	90.9	39.0	3.741.3	1,560.0
Betula papyrifera Marsh	109.3	51.4	3,142.8	1,467.3
Picea glauca (Moench) Voss.	17.4	-	149.4	-
Picea mariana (Mill.) B.S.P.	177.6	91.5	2,074.6	1,317.3
Pinus banksiana Lamb.	1,114.7	814.0	21,922.7	14,230.8
Pinus resinosa Ait.	7,219.0	4,657.2	120,105.5	82,315.4
Pinus strobus L.	3,763.2	1,307.4	84,058.1	29,273.9
Populus grandidentata Michx.	10.1	-	531.5	-
Populus tremuloides Michx.	.8	-	34.2	-
Quercus rubra L.	47.2	27.4	760.6	462.3
Thuja occidentalis L.	34.8	-	294.9	-
Stratum total	12,616.9		237,073.2	
Sapling				
Abies balsamea (L.) Mill.	12.9	8.4	109.2	70.9
Acer rubrum L.	82.0	51.9	1,266.1	844.7
Betula papyrifera Marsh.	15.7	12.3	631.5	495.4
Picea glauca (Moench) Voss.	2.7	1.8	17.2	10.9
Picea mariana (Mill.) B.S.P.	52.5	30.7	291.1	177.1
Pinus banksiana Lamb.	8.8	6.5	85.6	62.3
Pinus resinosa Ait.	22.2	14.1	219.2	139.9
Pinus strobus L.	36.6	16.4	651.0	293.5
Quercus rubra L.	34.1	18.4	325.2	177.4
Thuja occidentalis L.	12.2	-	60.7	-
Stratum total	279.7		3,656.8	
Tree seedling				
Abies balsamea (L.) Mill.	2.1	1.7	4.5	3.6
Acer rubrum L.	7.2	3.9	96.9	47.8
Betula papyrifera Marsh.	.6	.4	11.9	9.0
Picea glauca (Moench) Voss.	6.1	4.4	12.0	9.2
Picea mariana (Mill.) B.S.P.	34.0	18.1	63.0	32.1
Pinus resinosa Ait.	1.8	1.1	13.3	8.4
Pinus strobus L.	21.6	9.4	158.0	69.2
Populus tremuloides Michx.	.8	.3	4.4	1.7
Quercus rubra L.	13.2	5.9	66.4	31.3
Sorbus americana Marsh.	.4	.3	2.2	1.5
Stratum total	87.8		432.6	
Tall shrub				
Alnus crispa (Ait.) Pursh.	10.7	5.0	77.5	36.0
Amelanchier Medic. spp.	5.1	3.8	56.0	38.8
Corylus cornuta Marsh.	29.8	18.0	156.8	95.6
Lonicera canadensis Marsh.	.1	-	.2	-
Salix bebbiana Sarg.	.7	.5	2.5	2.4
Stratum total	46.4		293.0	
Low shrub				
Arctostaphylos Uva-ursi (L.) Spreng.			5.8	-
Chimaphila umbellata (L.) Bart.			1.0	.7
Comptonia peregrina B.&B. Small. Rydb.			.2	.2
Diervilla Lonicera Mill.			2.0	1.0
Gaultheria procumbens L.			33.2	13.1
Juniperus communis L.			89.0	59.7
Vaccinium angustifolium Ait.			150.6	53.9
Vaccinium myrtilloides Michx.			53.7	25.3
Stratum total			335.5	

(Table 13 continued on next page)

(Table 13.--continued)

	BWCAW			
	MATURE (n = 6)			
	Foliage		Total	
Stratum/species	X̄	SE	X̄	SE
Anemone quinquefolia L.	<0.1	-		
Aralia nudicaulis L.	6.0	3.9		
Aster macrophyllus L.	38.9	22.7		
Carex L. spp.	4.5	3.2		
Clintonia borealis (Ait.) Raf.	1.7	1.4		
Cornus canadensis L.	7.1	3.3		
Goodyera repens (L.) R. Br.	.1	.1		
Goodyera tesselata Lodd.	.2	-		
Grasses	32.8	21.2		
Linnaea borealis L.	.5	-		
Maianthemum canadense Desf.	6.8	1.0		
Melampyrum lineare Desr.	6.0	2.2		
Streptopus roseus Michx.	.1	-		
Trientalis borealis Raf.	.2	.1		
Stratum total	105.0			
Fern and fern allies				
Lycopodium annotinum L.	.6	-		
Lycopodium clavatum L.	.9	.6		
Lycopodium obscurum L.	1.0	-		
Polypodium virginianum L.	.1	-		
Pteridium aquilinum (L.) Kuhn.	10.5	6.8		
Stratum total	13.1			
Moss				
Calliergonella schreberi (Willd., BR. & Sch.) Grout	788.5	207.5		
Dicranum Hedw. spp.	246.6	62.8		
Hypnum crista-castrensis Hedw.	.7	-		
Polytrichum Hedw. spp.	36.8	12.0		
Sphagnum L. spp.	16.1	-		
All other mosses	160.2	39.7		
Stratum total	1,248.9			
Lichen				
Cladonia mitis Sandst.	122.6	83.9		
Cladonia rangiferina (L.) Web	364.2	205.6		
Cladonia sylvatica (L.) Hoffm.	66.1	-		
All other lichens	62.2	36.8		
Stratum total	615.1			
Community total			243,773.2	

Table 14.--Aboveground ovendry biomass by species and stratum for the jack pine-fir community type of northeastern Minnesota

(In Kg/ha)

	Prayer Lake Fire				Little Sioux Fire															
	1 n = 2				1 n = 2				3 n = 2				5 n = 2				1-5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree																				
Abies balsamea (L.) Mill.																				
Acer rubrum L.																	13.1	-	188.4	-
Betula papyrifera Marsh.																	4,328.9	2,714.6	95,155.8	58,088.9
Fraxinus nigra Marsh.																				
Picea glauca (Moench) Voss.																				
Picea mariana (Mill.) B.S.P.																				
Pinus banksiana Lamb.																				
Pinus resinosa Ait.																				
Pinus strobus L.																				
Populus balsamifera L.																				
Populus grandidentata Michx.																				
Populus tremuloides Michx.																	840.8	-	42,472.2	-
Thuja occidentalis L.																				
Stratum total																	5,182.8		137,816.4	
Sapling																				
Abies balsamea (L.) Mill.																				
Acer rubrum L.																				
Betula papyrifera Marsh.																				
Fraxinus nigra Marsh.																				
Picea glauca (Moench) Voss.																				
Picea mariana (Mill.) B.S.P.																				
Pinus banksiana Lamb.																				
Pinus strobus L.																				
Populus balsamifera L.																				
Populus grandidentata Michx.																				
Populus tremuloides Michx.																				
Sorbus americana Marsh.																				
Stratum total																				
Tree seedling																				
Abies balsamea (L.) Mill.																				
Acer rubrum L.													7.3	-	17.1	-				
Betula papyrifera Marsh.			<0.1	-					16.6	-	47.1	-	64.8	-	290.6	-	0.5	-	0.2	-
Larix laricina (DuRoi) K. Koch																				
Picea glauca (Moench) Voss.																				
Picea mariana (Mill.) B.S.P.																				
Pinus banksiana Lamb.			10.1	2.0			1.0	0.4	48.6	21.4	75.7	35.9	405.6	206.4	721.1	365.2				
Pinus strobus L.																				
Populus balsamifera L.																				
Populus grandidentata Michx.							285.9	-	46.7	-	141.5		1,205.7	1,169.4	5,218.0	5,098.4				
Populus tremuloides Michx.			5.0	4.2			170.4	170.3	381.1	380.9	1,573.0	1,572.6	386.5	374.9	2,683.4	2,647.1	278.1	99.0	1,914.3	697.3
Quercus rubra L.																				
Sorbus americana Marsh.																				
Thuja occidentalis L.																				
Tilia americana L.																				
Stratum total			15.2				457.3		493.0		1,837.3		2,069.9		8,930.2		278.6		1,916.3	
Tall shrub																				
Acer spicatum Lam.																	36.9	6.6	618.5	101.3
Alnus crispa (Ait.) Pursh.															696.4	-	.2	-	.9	-
Alnus rugosa (DuRoi) Spreng.																				
Amelanchier Medic. spp.							5.4	-	28.8	15.9	80.9	46.6								
Cornus rugosa Lam.																				
Cornus stolonifera Michx.																				
Corylus cornuta Marsh.							60.5	39.9	153.8	106.8	332.4	245.0	161.2	66.4	421.6	184.4	80.0	15.9	689.7	155.1
Lonicera canadensis Marsh.																	1.4	-	10.1	-
Lonicera dioica L.																				
Lonicera hirsuta Eat.																				
Lonicera oblongifolia (Goldie) Hook.																				
Lonicera villosa (Michx). R.dS.																				
Prunus pensylvanica L.F.							5.6	3.2	5.8	1.8	20.4	1.6	164.6	138.6	560.0	469.1	0.4	-	4.4	-
Prunus virginiana L.																	12.9	7.3	79.5	54.8
Rhus glabra																				
Salix bebbiana Sarg.																				
Salix L. spp.													18.1	-	48.8	-				
Viburnum edule (Michx.) Raf.																				
Viburnum rafinesquianum Schult.																				
Stratum total							71.5		205.0		480.3		343.9		1,726.8		131.8		1,403.1	
Low shrub																				
Arctostaphylos Uva-ursi (L.) Spreng.																				
Chimaphila umbellata (L.) Bart.							.8	.6			1.8	1.7			2.8	1.4				
Comptonia peregrina B.&B. Small. Rydb.							30.6	23.3			666.8	238.2			968.5	374.3				
Diervilla Lonicera Mill.			8.6	3.4			2.0	1.8							5.1	-			1.8	.5
Gaultheria hispidula (L.) Muhl.																				
Gaultheria procumbens L.			.1	-			4.2	-			23.5	21.9			18.0	15.0				
Juniperus communis L.																				
Ledum groenlandicum Oeder.																				
Ribes americanum											<.1	-								
Ribes glandulosum Grauer.																				
Ribes triste Pall.																				
Ribes L. spp.																				
Rosa blanda Ait.																				
Rosa acicularis Lindl.															14.4	7.2				
Rubus parviflorus Nutt.																				
Rubus pubescens Raf.															.5	-			.4	-
Rubus strigosus Michx.			.1	-			.5	.1			1.8	1.2			44.9	-			147.6	67.2
Vaccinium angustifolium Ait.			1.1	.9			5.4	.4			41.3	19.5			9.3	2.3			<.1	-
Vaccinium myrtilloides Michx.			1.2	-			3.6	3.2			7.2	3.4			38.8	.1				
Stratum total			11.1				47.1				742.5				1,102.3				149.9	

Isabella Plantations																Cherokee-Frost Lake				BWCAW			
6-10 n = 2				16-20 n = 2				21-25 n = 2				26-30 n = 2				33 n = 16				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
26.0	-	216.8	-													175.7	114.9	1,426.6	904.6	849.2	293.2	6,680.3	2,293.8
26.0	-	511.4	-																	28.4	19.5	1,256.3	955.3
				3.8	-	176.9	-	807.2	336.5	18,200.0	6,109.4	17.5	16.0	500.8	425.0	501.2	155.0	19,284.4	6,038.1	232.6	89.1	5,613.9	2,089.4
																				1.2	-	29.8	
1,819.8	-	17,229.8	-	479.2	450.4	3,108.8	2,938.1	3,654.6	1,871.0	28,686.1	10,449.2	88.4	-	736.2	-	388.3	281.6	2,547.8	1,875.8	554.5	349.3	4,934.7	3,131.5
				62.0	-	359.8	-	26.1	19.3	177.8	149.0	6,362.4	-	165,038.7	-	78.9	45.4	343.7	192.8	788.5	318.3	6,288.1	2,858.7
333.6	28.3	4,849.5	1,989.9	1,103.6	802.3	25,667.9	2,183.8	1,480.0	1,080.2	21,712.5	13,138.7	975.9	861.8	15,266.5	13,134.3	6,473.8	1,324.5	88,100.0	16,242.7	4,730.1	898.1	92,429.0	17,284.8
222.4	214.7	1,879.8	1,806.6	3,071.9	2,364.4	37,029.5	29,892.0	828.8	405.7	8,875.5	4,067.4	3,591.6	1,026.6	42,133.5	13,346.7					21.4	-	288.6	-
								40.9	-	807.4	-					1.6	-	25.4	-	168.6	148.7	3,759.3	3,329.9
																				7.8	6.1	366.3	288.1
																				12.3	-	967.6	-
45.6	40.5	915.6	849.7	432.6	342.5	10,243.9	8,425.7	93.9	50.6	2,187.4	1,222.0	67.7	1.4	1,840.9	461.4	285.3	134.5	10,001.6	4,890.4	762.8	297.3	44,817.3	18,450.1
																				33.0	23.6	307.7	219.2
2,473.4		25,602.9		5,153.1		76,586.8		6,931.5		80,646.7		11,103.5		225,516.6		7,904.8		121,729.6		8,190.4		168,279.0	
																9.0	6.1	80.6	54.0	352.3	135.7	2,985.4	1,146.2
																1.8	1.4	23.3	17.2	6.5	5.3	111.9	96.2
																104.5	32.3	4,404.3	1,379.2	26.9	8.5	1,007.3	307.4
																				<.1	-	.2	-
																.4	-	1.9	-	29.2	16.1	187.9	101.4
																151.6	105.0	862.2	604.1	376.4	240.1	2,091.6	1,305.2
																1,091.6	457.3	10,623.8	4,463.9	165.3	75.3	1,679.4	780.1
																				.7	.6	12.1	11.2
																				2.5	-	65.8	-
																				.6	.3	24.4	13.5
																73.2	43.8	1,601.3	975.0	26.9	15.0	653.3	363.6
																.8	.5	5.0	3.6	.4	.3	4.0	2.8
																1,432.1		17,602.4		987.6		8,823.3	

Isabella Plantations																Cherokee-Frost Lake				BWCAW			
6-10 n = 2				16-20 n = 2				21-25 n = 2				26-30 n = 2				33 n = 16				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
																55.8	17.1	130.6	40.2	62.5	24.2	146.3	56.6
0.1	-	0.8	-	0.7	-	6.2	-									.2	.1	3.6	1.4	2.5	1.2	33.9	15.7
																11.1	3.4	271.8	88.9	.6	.2	10.9	4.4
																				<.1	-	.2	-
																18.1	8.7	34.8	16.9	8.3	5.5	15.1	10.6
																70.8	17.3	136.2	33.4	14.2	7.9	27.4	15.3
																.4	.3	2.8	2.2				
																.2	.1	1.4	.8	.5	.3	3.2	1.9
																				.7	-	4.1	-
11.1	9.7	78.8	61.0	10.8	-	79.2	-					1.7	1.4	19.3	11.5	3.1	1.4	17.2	7.3	9.4	3.4	59.4	24.3
																				.3	.2	1.3	.9
																1.7	.5	9.1	2.8	1.8	1.4	16.8	14.5
																2.5	1.6	4.3	2.6	1.6	.9	2.9	1.7
11.2		79.6		11.5		85.4						1.7		19.3		163.9		612.0		102.5		321.6	
								<.1	-	.3	-					9.2	6.0	68.5	52.2	79.4	53.4	652.7	449.2
				15.0	-	136.5	-	107.5	89.4	1,006.1	843.8	74.1	10.3	709.6	103.2	12.1	6.2	113.1	57.2	15.5	12.4	121.1	101.4
																<.1	-	<.1	-	<.1	-	<.1	-
4.6	1.3	25.8	7.1	20.7	8.0	157.3	44.1	6.8	-	47.2	-	37.2	36.1	376.7	370.1	2.6	2.5	26.2	24.3	10.7	6.0	107.2	55.8
				13.2	-	66.6	-	.7	-	2.6	-	.1	-	.3	-	<.1	-	.1	-	12.0	11.5	67.4	66.2
																				<.1	-	<.1	-
11.6	3.3	95.7	15.9	168.0	13.2	1,473.8	69.9	34.4	24.0	326.9	229.5	61.5	24.1	562.9	221.3	10.8	5.4	62.7	36.6	96.9	44.0	614.3	276.5
								.1	-	1.2	-					.3	.2	1.6	1.4	2.2	.9	6.9	2.9
<.1	-	10.5	-	.4	-	1.5	-																
.4	<.1	1.1	.5	1.7	-	27.4	-	2.6	-	9.2	-									<.1	-	.1	-
												<.1	-	.2	-								
												.2	-	1.2	-					<.1	-	<.1	-

Isabella Plantations																Cherokee-Frost Lake				BWCAW			
6-10 n = 2				16-20 n = 2				21-25 n = 2				26-30 n = 2				33 n = 16				MATURE n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
2.2	-	25.4	-	2.9	-	30.9	-					<0.1	<0.1	0.6	0.2	30.3	13.8	385.1	263.0	<0.1	-	<0.1	-
5.7	-	26.2	-	4.4	-	31.0	-									<.1	-	<.1	-	4.7	-	75.1	-
																				<.1	-	<.1	-
																35.9	12.4	635.7	288.2	.1	.1	.1	<.1
.1	-	.2	-	<.1	-	<.1	-	.1	-	.2	-	112.1	45.6	1,174.0	299.8	1.3	-	11.2	-	9.7	-	311.6	-
																<.1	-	.3	-				
																				1.8	-	21.4	-
24.7		184.9		226.4		1,925.1		152.3		1,393.7		285.3		2,825.5		102.7		1,304.5		231.2		1,978.0	
										13.1	-											.4	-
						2.9	-			4.3	-			2.4	-			3.1	1.5			.3	.2
		16.8	-											16.3	-							.4	-
		42.3	41.0			51.3	28.5			11.2	-			40.5	9.6			21.3	7.6			43.2	27.6
																						2.4	1.6
														30.3	4.1							3.4	2.2
																		.8	-			16.1	-
										.5	-									.2	-	.3	-
																		<.1	-			<.1	-
																						<.1	-
																		.2	-			<.1	-
														4.7	-								
		13.5	12.9			12.8	8.1			30.3	.8			24.9	10.8			5.1	2.3			6.4	3.6
																						7.0	4.6
		.6	-			3.6	.7			2.7	2.4			.1	.1			3.9	1.7			3.5	1.6
		86.2	65.1			8.8	2.7			54.0	52.6			26.9	17.4			1.9	.8			4.7	2.2
		.2	.1			18.8	18.7			10.8	6.4			30.9	7.2			.1	.1			8.7	3.7
		6.6	-			23.1	1.2			53.7	4.7			13.4	-			3.6	2.3			5.7	2.7
		166.2				121.3				180.6				190.4				40.1				102.3	

(Table 14 continued on next page)

(Table 14.--continued)

	Prayer Lake Fire				Little Sioux Fire															
	1 n = 2				1 n = 2				3 n = 2				5 n = 2				1-5 n = 2			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Herb																				
Actaea rubra (Ait.) Willd.																				
Anaphalis margaritacea (L.) C.B. Clarke																				
Anemone quinquefolia L.					<0.1	-			0.2	-							<0.1	-		
Antennaria spp. Gaertn.	0.1	-															<.1	-		
Apocynum androsaemifolium L.					.5	-											5.0	-		
Aralia hispida Vent.	.1	-			.2	.1			26.2	-			41.5	-						
Aralia nudicaulis L.					6.4	4.2			39.3	6.7			37.6	33.5			2.5	1.9		
Aster ciliolatus Lindl.																				
Aster macrophyllus L.	75.6	-			289.4	3.1			284.6	17.8			241.5	100.7			82.9	9.5		
Carex L. spp.	14.2	7.2			74.2	28.4			183.0	122.6			15.4	13.2						
Circaea alpina L.																				
Clintonia borealis (Ait.) Raf.					7.4	4.6			32.2	13.5			33.5	7.3			4.8	-		
Coptis groenlandica (Oeder) Fern.																				
Corallorhiza maculata Raf.																				
Cornus canadensis L.					17.6	13.4			71.1	35.9			83.1	78.2			1.5	-		
Corydalis sempervirens (L.) Pers.	18.2	17.2																		
Epilobium angustifolium L.	6.6	1.2							4.5	-										
Fragaria vesca L.																	5.6	4.2		
Fragaria virginiana Duchesne.																	2.8	.9		
Galium triflorum Michx.																	<.1	-		
Geranium bicknellii Britt.	197.9	80.6	197.9	80.6	13.6	-			<.1	-										
Goodyera repens (L.) R. Br.									<.1	-										
Goodyera tesselata Lodd.																				
Grasses	<.1	-			6.6	4.0			120.4	49.2			53.6	37.6			65.5	15.0		
Lactuca L. spp.																				
Lathyrus ochroleucus Hook.																	7.8	6.3		
Lathyrus palustris L.																				
Lathyrus venosus Muhl.																				
Lathyrus L. spp.																				
Linnaea borealis L.	<.1	-			1.2	.5			40.4	34.6			37.5	29.5						
Lycopus uniflorus																				
Maianthemum canadense Desf.	.1	0			3.0	2.2			32.6	10.4			20.4	2.8			2.1	1.0		
Herbs (cont.)																				
Melampyrum lineare Desr.									0.2	-			1.4	-						
Mentha L. spp.	3.0	-																		
Mitella nuda L.																				
Moneses uniflora (L.) Gray																				
Petasites palmatus (Ait.) Gray																				
Polygala paucifolia Willd.																				
Polygonum cilinode Michx.	7.8	7.1			2.2	-			15.8	13.2			.8	0			<0.1	0		
Pyrola asarifolia Michx.																				
Pyrola elliptica Nutt.																				
Pyrola secunda L.																				
Pyrola virens Schweigg.																				
Pyrola L. spp.					.1	-			.8	-										
Solidago ulignosa																				
Streptopus roseus Michx.																	.2	-		
Taraxacum Zinn. spp.																				
Trientalis borealis Raf.					.5	-							1.0	.1			<.1	<.1		
Trifolium repens																				
Vicia americana Muhl.																				
Viola L. spp.																	.2	-		
Waldsteinia fragarioides (Michx.) Tratt.																				
Stratum total	325.7				423.0				851.4				567.3				181.0			
Fern and fern allies																				
Athyrium filix-femina (L.) Roth.																				
Dryopteris Phegopteris L.																				
Dryopteris spinulosa (O.F. Muell.) Watt																				
Equisetum sylvacaticum L.																				
Equisetum L. spp.																				
Gymnocarpium Dryopteris (L.) Newm.																				
Lycopodium annotinum L.																				
Lycopodium clavatum L.																				
Lycopodium complanatum L.					.1	-			23.8	-			11.2	-						
Fern and fern allies (cont.)																				
Lycopodium obscurum L.									13.4	3.6							<0.1	0		
Osmunda claytoniana L.																				
Polypodium virginianum L.																				
Pteridium aquilinum (L.) Kuhn.					203.1	136.1			261.1	56.4			215.6	68.6			9.7	-		
Woodsia ilvensis (L.) R. Br.																				
Stratum total					203.2				298.3				226.8				9.8			
Moss																				
Calliergonella schreberi (Willd., BR. & Sch.) Grout																				
Dicranum Hedw. spp.																				
Hylocomium splendens (Hedw.) B.S.G.																				
Hypnum crista-castrensis Hedw.																				
Polytrichum Hedw. spp.	2.3	1.9							.7	.6			.9	.1						
Sphagnum L. spp.																				
All other mosses																				
Stratum total	2.3								.7				.9							
Lichen																				
Cladonia mitis Sandst.																				
Cladonia rangiferina (L.) Web.																				
Cladonia sylvatica (L.) Hoffm.																				
All other lichens																				
Stratum total																				
Unidentified plants	.1	0			<.1	-														
Community total			354.4				1,202.2				4,210.5				12,554.3				141,476.5	

Isabella Plantations																Cherokee-Frost Lake				BWCAW			
6-10				16-20				21-25				26-30				33				MATURE			
n = 2				n = 2				n = 2				n = 2				n = 16				n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
								0.1	-														
																1.1	1.0			0.3	-		
<0.1	-			<0.1	-			<.1	-			0.6	0.6			<.1	<.1			<.1	<.1		
3.6	-			4.6	-			4.6	-			.2	-			.5	.4			.2	-		
.1	-			13.6	2.9			8.9	5.3			5.4	2.0			25.4	6.9			14.9	7.1		
4.9	-			.7	-			12.3	-							.2	.1			.2	-		
63.3	46.1			89.1	12.3			143.4	27.9			68.9	32.9			80.6	14.4			103.2	18.2		
												<.1	-			4.0	1.2			4.5	1.7		
																				.1	-		
7.2	-			7.7	-			8.2	2.6			12.7	5.7			3.3	1.6			7.9	3.3		
																.7	.4			4.4	2.4		
																.1	-						
1.8	-			4.1	-			7.8	1.9			2.7	.4			30.8	5.0			26.7	10.4		
												.9	.7			5.7	2.9			.2	-		
3.1	-							4.2	-			4.7	0			.5	.2			1.9	1.0		
2.5	-							4.2	-			2.0	-							3.2	-		
.2	-															.1	.1			1.2	1.1		
																1.0	.2			.1	-		
																.1	-			.2	.1		
212.3	18.9			238.9	85.4			226.6	114.2			85.3	24.7			12.5	4.2			30.8	7.1		
<.1	-																						
6.2	1.3							13.8	11.1			2.2	-			.2	-			3.6	2.3		
				4.4	-																		
								.7	-											.2	-		
1.7	-																						
1.6	-			1.6	-							5.6	-			23.8	8.0			17.7	5.2		
																.2	-						
2.2	.3			4.9	.7			1.4	-			3.1	2.1			4.5	1.1			8.4	1.6		

Isabella Plantations																Cherokee-Frost Lake				BWCAW			
6-10				16-20				21-25				26-30				33				MATURE			
n = 2				n = 2				n = 2				n = 2				n = 16				n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
								<0.1	-							0.1	0.1			0.5	0.4		
																<.1	-			1.7	1.6		
																<.1	-						
																.3	.3						
<0.1	-							<.1	-			<0.1	-							.5	-		
																.1	.1						
																				.1	-		
																.2	.1			.1	.1		
								.1	-							.4	.1			.3	.2		
																.1	.1			.1	-		
								.1	-			3.2	1.0										
																.1	-						
								<.1	-			<.1	-			.6	.2			.4	.2		
																				.1	-		
<.1	-											<.1	-			.1	.1			.5	.2		
																				1.5	-		
																				.7	.5		
1.3	-							.1	-							.8	.4			7.0	.3		
																.3	.3			.1	-		
312.1				369.7				436.6				197.6				198.5				237.5			
																				.8	-		
																.5	-						
																.1	.1			1.6	1.0		
																				.1	-		
																.3	.2			.2	.2		
																				2.1	1.9		
												<.1	-			1.1	-			3.9	2.2		
<.1	-															3.9	2.1			4.3	2.2		
				<.1	-							<.1	0							.3	-		

Isabella Plantations																Cherokee-Frost Lake				BWCAW			
6-10				16-20				21-25				26-30				33				MATURE			
n = 2				n = 2				n = 2				n = 2				n = 16				n = 10			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
<0.1	-			<0.1	-			<0.1	-			<0.1	-			0.4	0.2			7.7	3.0		
																				4.4	-		
																				.4	.3		
44.3	27.6			123.1	8.5			322.4	92.4			99.9	13.7			3.0	2.2			14.6	6.0		
																				.1	-		
44.4				123.2				322.5				100.0				9.3				40.3			
																311.4	48.6			528.6	98.2		
																25.4	6.2			36.7	21.7		
																.5	.3			.7	-		
																3.0	1.0			1.0	.7		
																102.6	32.4			85.0	47.3		
																				1.0	-		
																165.5	18.0			292.3	61.5		
																608.5				945.2			
																				22.2	14.8		
																47.6	13.0			62.4	36.5		
																14.2	6.6						
																56.6	11.0			14.8	5.4		
																118.5				99.5			
		26,390.1				79,211.5				82,980.1				228,849.4				141,958.1				180,826.8	

Table 15.--Aboveground ovendry biomass by species and stratum for the jack pine-black spruce community type of northeastern Minnesota

(In Kg/ha)

	Little Sioux Fire																			
	1 n = 1				3 n = 1				5 n = 1				6-10 n = 6				11-15 n = 4			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Tree																				
Abies balsamea (L.) Mill.													156.0	154.0	1,171.5	1,156.8	1.9	-	16.8	-
Acer rubrum L.													1.5	-	23.6	-				
Betula papyrifera Marsh.													2,305.5	2,298.9	46,523.0	46,294.4	108.3	63.4	5,596.9	1,164.5
Picea glauca (Moench) Voss.													62.6	42.6	468.6	355.1	5.0	-	32.5	-
Picea mariana (Mill.) B.S.P.													243.0	159.4	1,763.4	1,262.4	275.9	228.7	2,411.6	2,064.8
Pinus banksiana Lamb.													894.8	271.1	12,026.4	5,014.7	2,117.6	645.2	21,346.2	6,049.0
Pinus resinosa Ait.													48.9	35.4	471.7	316.5	1,074.7	876.0	10,481.4	8,712.0
Pinus strobus L.																				
Populus grandidentata Michx.																				
Populus tremuloides Michx.													176..7	72.5	8,371.1	5,047.7	149.5	120.5	3,397.8	2,868.3
Quercus rubra L.																				
Thuja occidentalis L.																				
Stratum total													3,889.0		70,819.3		3,732.9		43,283.2	
Sapling																				
Abies balsamea (L.) Mill.																				
Acer rubrum L.																				
Betula papyrifera Marsh.																				
Picea glauca (Moench) Voss.																				
Picea mariana (Mill.) B.S.P.																				
Pinus banksiana Lamb.																				
Pinus resinosa Ait.																				
Pinus strobus L.																				
Populus grandidentata Michx.																				
Populus tremuloides Michx.																				
Quercus rubra L.																				
Sorbus americana Marsh.																				
Thuja occidentalis L.																				
Stratum total																				
Tree seedling																				
Abies balsamea (L.) Mill.																				
Acer rubrum L.									4.0		16.2									
Betula papyrifera Marsh.									342.2		1,221.4		3.9	2.0	41.9	24.3	0.5	0.2	1.7	0.7
Picea glauca (Moench) Voss.																				
Picea mariana (Mill.) B.S.P.							<0.1													
Pinus banksiana Lamb.			1.4		60.7		95.8		658.4		1,387.8									
Pinus resinosa Ait.																				
Pinus strobus L.																				
Populus grandidentata Michx.					.9		1.4		251.5		1,265.7									
Populus tremuloides Michx.			34.9		13.9		34.2		53.0		235.8		31.5	15.4	227.0	108.4	24.1	18.4	183.8	134.5
Quercus rubra L.																				
Sorbus americana Marsh.											310.6		<.1	-	.1	-				
Thuja occidentalis L.																				
Stratum total			36.3		75.5		131.5		1,309.1		4,437.5		35.5		269.0		24.6		185.5	
Tall shrub																				
Acer spicatum Lam.													10.2	6.5	121.7	68.2				
Alnus crispa (Ait.) Pursh.													180.7	100.8	1,673.9	937.6	46.2	16.8	415.2	153.4
Alnus rugosa (OuRoi) Spreng.																				
Amelanchier Medic. spp.			14.5										7.5	2.9	57.0	25.0	29.9	6.2	269.5	75.2
Cornus rugosa Lam.																				
Cornus stolonifera Michx.													4.3	-	27.7	-				
Corylus cornuta Marsh.													74.5	37.6	645.1	321.1	74.6	29.6	678.4	260.5
Lonicera canadensis Marsh.													1.2	.5	8.6	3.3	2.4	1.4	17.9	9.9
Lonicera dioica L.													.2	-	.2	-				
Lonicera hirsuta Eat.													.4	.3	1.2	.9	.1	-	.2	-
Lonicera oblongifolia (Goldie) Hook.													.2	.2	.8	.5				
Prunus pensylvanica L.F.			.5		12.6		28.7		84.8		396.2		14.9	6.7	151.2	67.5	12.3	5.4	124.0	51.0
Prunus virginiana L.													7.1	-	47.7	-	3.0	-	14.3	-
Tall shrub (cont.)																				
Rhamnus alnifolia L'Her.																				
Salix bebbiana Sarg.																				
Salix L. spp.													11.9	6.8	84.6	54.9	2.7	1.6	14.5	8.8
Viburnum rafinesquianum Schult.																				
Stratum total			15.0		26.9		80.5		84.8		396.2		313.1		2,819.7		171.2		1,534.0	
Low shrub																				
Arctostaphylos Uva-ursi (L.) Spreng.															4.4	-				
Chimaphila umbellata (L.) Bart.															5.1	3.4				
Comptonia peregrina B.&B. Small. Rydb.			37.2				201.1				113.0				17.6	11.4			25.5	10.3
Diervilla Lonicera Mill.			5.3				239.6				74.8				18.1	9.2			60.0	43.1
Gaultheria hispidula (L.) Muhl.																				
Gaultheria procumbens L.			7.3				21.1				47.1									
Juniperus communis L.																				
Ledum groenlandicum Oeder.															<.1	-				
Ribes L. spp.															9.5	9.4				
Rosa blanda Ait.																			.8	-
Rosa acicularis Lindl.															34.1	14.7			24.5	10.5
Rubus parviflorus Nutt.																				
Rubus pubescens Raf.															3.0	2.2			2.5	2.1
Rubus strigosus Michx.							27.3				15.2				79.0	21.1			39.6	18.5
Vaccinium angustifolium Ait.			12.0				240.3				101.2				4.3	3.2			50.0	27.2
Vaccinium myrtilloides Michx.			9.6				35.8				65.7				5.5	2.6			15.8	6.7
Stratum total			71.4				765.2				1,417.0				180.7				218.7	

Isabella Plantations												Cherokee-Frost Lake				BWCAW			
16-20				21-25				26-30				33				MATURE			
n = 4				n = 3				n = 6				n = 3				n = 17			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
				153.2	-	1,178.1	-					173.7	-	1,402.4	-	52.2	32.4	416.6	259.7
																28.9	13.3	1,021.3	456.0
				1,008.7	884.3	21,386.5	17,343.0	204.6	97.1	5,396.9	2,235.2	307.0	293.6	12,681.3	11,989.5	72.7	33.9	1,993.6	976.2
136.5	94.4	988.4	681.8	262.8	-	2,114.3	-	34.8	-	288.0	-					70.1	36.9	545.4	272.4
339.5	-	2,816.6	-	416.0	356.6	2,962.8	2,665.1	7.5	-	41.5	-	82.9	-	466.2	-	3,891.9	664.9	30,865.7	5,364.6
641.2	266.5	12,463.3	7,813.0	664.5	294.1	10,595.0	5,549.3	3,598.0	1,595.8	58,030.5	26,973.2	8,631.0	4,949.8	101,547.7	50,134.3	5,401.6	701.2	101,136.5	12,660.6
5,502.4	779.1	57,614.4	8,610.8	3,245.1	104.3	35,601.1	5,123.5	4,625.5	1,235.9	54,860.7	14,983.8					496.9	290.4	6,726.8	3,956.4
												147.2	-	2,616.0	-	179.6	99.8	4,138.6	2,323.8
																10.1	7.3	773.5	565.4
285.1	235.4	7,361.0	6,232.5	403.8	362.2	25,896.8	24,278.6	235.5	218.1	8,322.1	7,780.9	102.9	-	4,004.2	-	127.2	29.8	6,069.6	1,458.8
																8.4	-	156.5	-
				.1	-	.1	-												
6,904.7		81,243.7		6,154.2		99,734.7		8,705.9		126,939.7		9,444.7		122,717.8		10,339.6		153,844.2	
																36.1	15.6	307.6	133.0
																10.0	4.9	177.4	95.2
												133.9	-	5,115.1	-	29.7	9.0	1,109.9	338.7
												10.3	-	60.1	-	15.7	10.2	100.5	65.1
												234.6	-	1,087.0	-	1,751.9	339.9	10,259.3	1,974.8
												854.0	-	8,143.9	-	70.5	34.2	750.4	371.7
																15.5	10.9	152.2	106.6
																2.9	1.8	52.2	32.0
																.3	-	10.0	-
																4.7	2.2	124.3	59.0
																.3	-	2.5	-
												.2	.2	.6	.4				
												1,233.0		14,406.7		1,937.6		13,046.4	

Isabella Plantations												Cherokee-Frost Lake				BWCAW			
16-20				21-25				26-30				33				MATURE			
n = 4				n = 3				n = 6				n = 3				n = 17			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
												61.4	34.6	137.6	80.3	13.1	4.2	30.7	9.6
						16.2	-					.1	-	2.6	-	5.6	2.2	98.7	40.9
0.2	0.1	1.1	0.8					0.1	0.1	0.2	0.2	9.3	1.8	246.7	44.4	.6	.2	13.1	5.9
												3.0	-	5.1	-	.2	.1	.3	.2
												45.6	30.7	86.5	60.6	23.2	6.0	42.0	11.3
												.2	-	1.2	-	.1	-	.3	-
																<.1	-	.2	-
												.7	-	4.3	-	2.7	1.1	20.7	9.0
																.1	-	.6	-
11.2	8.4	65.6	43.4	1.1	1.0	11.5	9.7	.1	-	1.3	-					4.1	.9	25.1	6.0
																.2	.2	1.0	.7
				.8	-	5.4	-					3.2	1.6	16.3	7.9	1.3	.7	8.0	4.8
												1.6	-	2.6	-				
11.4		66.7		7.3		63.1		.2		1.5		125.0		502.9		51.1		240.7	
				9.5	5.5	117.2	63.5	10.3	-	95.6	-	2.2	2.1	9.0	8.7	1.0	.8	8.2	7.9
98.5	69.4	965.5	684.9	180.9	111.8	1,874.5	1,213.6	52.2	15.1	509.3	155.4					6.1	4.1	48.2	32.3
				11.7	-	128.2	-												
38.0	13.6	320.1	132.1	25.1	17.2	239.8	185.2	29.1	18.2	279.2	196.2	<.1	<.1	.7	.1	.4	.2	6.3	3.1
								3.0	-	16.4	-								
97.4	20.3	889.2	178.4	276.0	183.5	2,304.2	1,515.0	246.8	42.6	2,092.5	351.8	33.2	32.8	200.0	199.6	15.3	10.7	90.8	65.9
2.1	1.4	14.4	9.8	.7	-	4.4	-	3.4	1.9	21.3	12.2	.4	.3	1.2	1.0	.5	.2	1.6	.8
								.5	-	4.8	-					.1	.1	.1	.1
.2	-	.8	-	<.1	-	.1	-	.6	.4	2.3	1.5								
2.5	-	25.8	-	2.6	-	26.1	-	1.1	.5	11.9	5.2	4.8	4.8	36.3	36.0	<.1	<.1	<.1	<.1
9.9	-	89.1	-	3.1	2.6	17.8	15.9												

Isabella Plantations												Cherokee-Frost Lake				BWCAW			
16-20				21-25				26-30				33				MATURE			
n = 4				n = 3				n = 6				n = 3				n = 17			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
								4.2	-	28.6	-								
												0.1	0.1	0.2	0.1	2.3	1.9	28.6	26.8
				5.2	-	36.1	-	1.3	-	8.0	-								
				3.1	-	15.2	-												
248.6		8,304.9		518.0		4,763.6		352.5		3,069.9		40.8		247.2		25.8		183.8	
		3.4	-							.6	-			2.1	1.5			.3	.1
		2.9	-							.6	-							.2	-
		74.4	33.4			68.0	31.7			14.6	5.0			8.1	5.2			10.2	4.7
																		.6	.4
		5.7	-			8.0	5.4											10.5	3.4
										4.9	-							36.2	27.3
		.2	-																
		.7	-																
		22.3	10.6			5.6	3.0			8.0	2.2			2.2	-			1.2	.9
		1.2	.8			.3	.2			.4	.2			1.2	-			.1	.1
		25.2	9.0			10.2	5.0			9.7	5.1			.3	-			1.8	1.6
		20.8	11.4			19.3	11.2			3.6	1.3			.8	-			25.4	9.8
		32.6	12.5			9.5	8.3							8.4	-			4.0	1.9
		189.4				120.9				42.4				23.0				91.3	

(Table 15 continued on next page)

(Table 15.--continued)

	Little Sioux Fire																			
	1 n = 1				3 n = 1				5 n = 1				6-10 n = 6				11-15 n = 4			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Herb																				
Actaea rubra (Ait.) Willd.													<0.1	-						
Anaphalis margaritacea (L.) C.B. Clarke													<.1	-			<0.1	-		
Anemone quinquefolia L.					0.2								<.1	<0.1			<.1	<0.1		
Antennaria neodioca Greene																				
Antennaria spp. Gaertn.													<.1	<.1						
Apocynum androsaemifolium L.													1.4	.8			.4	.2		
Aralia hispida Vent.	.7				383.6				55.1											
Aralia nudicaulis L.	1.4				21.9				26.6				3.8	1.4			11.0	6.5		
Aster ciliolatus Lindl.													.7	-						
Aster macrophyllus L.	88.3				278.6				184.1				45.7	30.1			87.6	49.3		
Carex L. spp.					124.1								<.1	<.1			<.1	-		
Clintonia borealis (Ait.) Raf.	8.8				12.7				28.9				8.1	5.4			11.4	5.8		
Coptis groenlandica (Oeder) Fern.																	<.1	<.1		
Cornus canadensis L.	41.4				227.7				255.9				9.5	5.2			12.9	2.8		
Epilobium angustifolium L.									2.5								.4	.2		
Fragaria vesca L.													2.9	1.3			1.6	.6		
Fragaria virginiana Duchesne.													8.1	3.1			3.2	.7		
Galium triflorum Michx.													<.1	<.1						
Geranium bicknellii Britt.	<.1				6.6															
Goodyera repens (L.) R. Br.																				
Goodyera tesselata Lodd.																				
Grasses	2.4				21.4				10.4				158.0	61.5			115.2	29.7		
Habenaria orbiculata (Pursh) Torr.																				
Hepatica americana (D.C.) Ker.													<.1	-						
Lactuca L. spp.													<.1	-						
Lathyrus ochroleucus Hook.													4.1	2.0			.7	-		
Lathyrus palustris L.													.2	-						
Lathyrus venosus Muhl.													.2	-						
Linnea borealis L.									.9				1.9	1.0			17.0	8.0		
Maianthemum canadense Desf.	5.4				34.1				11.3				2.4	1.0			5.8	1.9		
Melampyrum lineare Desr.									2.4				<.1	-						
Grasses																				

	Little Sioux Fire																			
	1 n = 1				3 n = 1				5 n = 1				6-10 n = 6				11-15 n = 4			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Herb (cont.)																				
Monotropa uniflora L.																				
Petasites palmatus (Ait.) Gray													<0.1	-						
Petasites vitifolius Rydb.																				
Polygala paucifolia Willd.													<.1	<0.1			<0.1	<0.1		
Polygonum cilinode Michx.	0.9				25.8				2.0											
Potentilla tridentata Soland.																				
Pyrola elliptica Nutt.																	.7	-		
Pyrola rotundifolia L.																				
Pyrola secunda L.													1.0	.6						
Pyrola virens Schweigg.													.4	-						
Pyrola L. spp.									.4											
Senecio L. spp.													<.1	-						
Solidago L. spp.													<.1	<.1			<.1	-		
Streptopus roseus Michx.													.1	<.1			<.1	<.1		
Taraxacum officinale Weber.																				
Trientalis borealis Raf.	.2												<.1	<.1			<.1	0		
Vicia americana Muhl.																				
Viola adunca J. E. Smith																	.1	-		
Viola L. spp.													.9	.3			.3	.2		
Waldsteinia fragarioides (Michx.) Tratt.																				
Stratum total	149.6				1,136.7				580.5				249.7				268.4			
Fern and fern allies																				
Dryopteris spinulosa (O.F. Muell.) Watt													.3	-			.1	-		
Lycopodium annotinum L.																				
Lycopodium clavatum L.																	<.1	<.1		
Lycopodium complanatum L.																	<.1	-		
Lycopodium lucidulum Michx.													<.1	-						
Lycopodium obscurum L.					34.1								<.1	<.1						
Polypodium virginianum L.																				
Pteridium aquilinum (L.) Kuhn.	273.7				403.0				599.8				11.1	8.2			11.6	6.8		
Stratum total	273.7				437.1				599.8				11.5				11.8			

	Little Sioux Fire																			
	1 n = 1				3 n = 1				5 n = 1				6-10 n = 6				11-15 n = 4			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Moss																				
Calliergonella schreber (Willd., BR. & Sch.) Grout																				
Dicranum Hedw. spp.																				
Hylocomium splendens (Hedw.) B.S.G.																				
Hypnum crista-castrensis Hedw.																				
Polytrichum Hedw. spp.					12.3				10.2											
All other mosses																				
Stratum total					12.3				10.2											
Lichen																				
Cladonia alpestris (L.) Rabenh.																				
Cladonia mitis Sandst.																				
Cladonia rangiferina (L.) Web.																				
Cladonia sylvatica (L.) Hoffm.																				
Peltigera aphthosa (L.) Willd.																				
All other lichens																				
Stratum total																				
Liverworts					<.1															
Unidentified	<.1		.1	-																
Community total			546.1				2,563.5				7,441.2				74,349.9				45,501.6	

Isabella Plantations												Cherokee-Frost Lake				BWCAW			
16-20				21-25				26-30				33				MATURE			
n = 4				n = 3				n = 6				n = 3				n = 17			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												0.2	-						
<0.1	<0.1			<0.1	<0.1			<0.1	<0.1							0.1	0.1		
												2.8	-						
<.1	-																		
.6	-							2.3	-			.8	-			.2	.2		
7.2	5.5			13.7	7.7			11.5	6.9			15.9	8.8			4.5	1.6		
52.5	14.0			99.8	38.1			40.8	15.4			78.0	59.2			35.5	7.3		
<.1	-							<.1	-			.9	-			2.1	1.3		
7.0	.2			22.8	11.1			4.4	1.5			3.2	1.4			3.1	1.3		
				<.1	-			<.1	<.1			.2	-			.2	-		
5.8	3.8			16.6	6.9			9.6	3.6			41.2	28.7			25.4	8.0		
												2.7	-						
1.8	-							4.1	3.4			.6	-			.6	.4		
2.8	1.4			2.2	-			.8	.5			1.5	1.0						
												.1	-						
																.4	.2		
												.4	-			.2	.2		
165.0	93.7			134.1	115.7			47.9	8.0			9.0	5.3			8.6	2.4		
																.2	-		
				.9	-			.7	-							.3	-		
5.8	4.3			5.8	4.7			10.9	4.9			29.5	25.1			12.7	4.4		
2.9	1.5			4.1	1.8			5.3	1.4			9.5	6.8			9.9	1.7		
																.4	.2		
<.1	-																		

Isabella Plantations												Cherokee-Frost Lake				BWCAW			
16-20				21-25				26-30				33				MATURE			
n = 4				n = 3				n = 6				n = 3				n = 17			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
																<0.1	-		
																.1	-		
<0.1	<0.1			<0.1	<0.1														
																.1	-		
																<.1	-		
2.7	.4			2.6	1.5							0.6	-			.1	0.1		
				.8	-											.1	<.1		
.7	-							0.6	-										
.1	-			.8	.7							.9	-			.2	.1		
				<.1	-														
				<.1	-			<.1	-			.5	.5			.2	.1		
																.1	-		
.3	-			.4	-														
								.2	.1			.2	.1			.1	<.1		
255.3				304.7				139.2				198.7				105.3			
								.1	-							.2	-		
								<.1	-							1.6	1.0		
<.1	-			<.1	0			<.1	-			14.5	12.8			3.7	1.8		
																.7	.6		
								<.1	-										
<.1	-			<.1	<.1			2.2	-			1.1	-			.6	.3		
																.5	.4		
49.1	28.4			77.4	-			28.1	22.8							15.5	6.3		
49.2				77.5				30.5				15.6				22.8			

Isabella Plantations												Cherokee-Frost Lake				BWCAW			
16-20				21-25				26-30				33				MATURE			
n = 4				n = 3				n = 6				n = 3				n = 17			
Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
												386.5	241.1			1,920.9	239.8		
												25.1	9.5			212.3	32.2		
																20.5	12.4		
												.9	-			25.8	15.4		
												125.3	77.2			17.3	6.9		
												135.1	26.5			198.4	47.4		
												673.0				2,395.2			
																66.9	-		
																1.6	-		
												44.1	17.6			113.3	63.9		
												7.1	1.8			2.5	-		
												60.4	26.9			34.1	15.1		
												111.5				218.3			
		84,109.2				105,064.5				130,223.2				135,896.6				170,148.0	

Table 16.--Aboveground ovendry biomass by species and stratum for the black spruce-feather moss community type of northeastern Minnesota

(In Kg/ha)

	Isabella Plantations												BWCAW			
	11-15 n = 3				16-20 n = 3				21-25 n = 1				MATURE n = 19			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Tree																
Abies balsamea (L.) Mill.													871.8	298.7	6,946.4	2,382.7
Acer rubrum L.	5.9	-	66.2	-	62.0	56.6	874.7	810.4					1.1	-	45.4	-
Betula papyrifera Marsh.									1,297.6		31,235.0		396.5	158.1	9,494.7	3,540.5
Picea glauca (Moench) Voss.	1.3	-	7.4	-	335.0	-	2,332.9	-					455.3	159.1	3,986.4	1,365.0
Picea mariana (Mill.) B.S.P.	99.2	72.5	864.1	690.9					264.2		2,029.6		5,642.7	1,115.0	46,118.7	9,068.4
Pinus banksiana Lamb.	94.2	72.1	794.5	634.1	13.9	-	95.2	-	478.0		6,235.0		1,292.8	489.0	24,828.0	9,159.2
Pinus resinosa Ait.	1,648.5	650.3	16,669.2	6,699.7	1,365.2	853.3	14,681.7	9,041.1	1,149.6		12,950.1		188.6	139.4	2,451.7	1,804.4
Pinus strobus L.					3,561.4	-	39,939.7	-					207.7	98.1	4,528.7	2,121.4
Populus grandidentata Michx.					.4	-	11.2	-					8.6	7.1	624.2	534.1
Populus tremuloides Michx.	237.2	82.6	4,757.4	1,720.1	102.6	71.8	2,086.5	1,445.0					405.9	121.3	19,356.7	5,898.3
Sorbus americana Marsh.													.8	-	8.9	-
Thuja occidentalis L.													76.1	41.7	554.8	301.9
Stratum total	2,086.3		23,158.8		5,440.5		60,021.9		3,189.4		52,449.7		9,547.9		118,944.6	
Sapling																
Abies balsamea (L.) Mill.													465.1	188.0	3,922.6	1,583.3
Acer rubrum L.													2.0	1.4	33.5	24.5
Betula papyrifera Marsh.													65.2	16.3	2,416.4	605.0
Picea glauca (Moench) Voss.													13.5	7.2	84.8	44.9
Picea mariana (Mill.) B.S.P.													1,894.4	532.1	11,215.9	3,144.5
Pinus banksiana Lamb.													25.9	16.1	265.6	167.5
Pinus resinosa Ait.													1.1	.7	10.2	7.0
Pinus strobus L.													3.6	2.6	62.3	44.9
Populus grandidentata Michx.													1.4	1.2	57.6	49.7
Populus tremuloides Michx.													36.2	11.7	954.8	311.6
Sorbus americana Marsh.													.4	.3	3.3	2.4
Thuja occidentalis L.													34.0	16.8	160.2	80.4
Stratum total													2,542.8		19,187.2	

(Table 16 continued on next page)

(Table 16.--continued)

	Isabella Plantations												8WCAW MATURE n = 19			
	11-15 n = 3				16-20 n = 3				21-25 n = 1							
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE	X̄	SE
Tree seedling																
Abies balsamea (L.) Mill.													55.2	13.8	119.5	30.2
Acer rubrum L.	0.2	-	1.8	-	40.8	40.3	346.2	342.1	4.4		9.4		.6	.4	11.9	9.1
Betula papyrifera Marsh.	.7	0.3	2.7	1.5	.6	-	8.5	-					1.6	.5	38.6	17.0
Fraxinus nigra Marsh.													.3	.2	1.3	.9
Picea glauca (Moench) Voss.													2.3	.8	3.8	1.4
Picea mariana (Mill.) B.S.P.													20.5	8.6	36.7	16.1
Pinus resinosa Ait.													.2	.2	2.1	1.9
Pinus strobus L.													1.1	.7	8.3	5.6
Populus tremuloides Michx.	48.4	8.1	340.0	46.1	36.4	25.8	280.5	195.6					4.9	1.8	28.1	11.3
Quercus rubra L.													.1	-	.4	-
Sorbus americana Marsh.													2.4	.5	12.8	2.7
Thuja occidentalis L.													35.0	33.6	76.8	74.3
Tilia americana L.																
Stratum total	49.3		344.5		77.8		635.2		4.4		9.4		124.2		340.3	
Tall shrub																
Acer spicatum Lam.													8.8	4.0	56.6	27.9
Alnus crispa (Ait.) Pursh.									110.9		1,057.1		9.5	4.6	68.4	32.8
Amelanchier Medic. spp.	11.3	11.0	69.7	68.2	16.6	8.5	120.0	61.4	29.6				4.1	3.3	48.3	37.4
Cornus rugosa Lam.	10.3	9.3	45.6	41.4	9.5	-	39.5	-					1.0	.9	5.0	4.8
Corylus cornuta Marsh.	42.2	13.4	371.7	114.6	53.3	21.8	475.5	195.4	121.3		1,054.3		32.3	22.5	206.8	150.4
Lonicera canadensis Marsh.					.6	.5	4.5	3.6					1.6	.5	6.9	2.3
Lonicera hirsuta Eat.					.1	-	.2	-								
Lonicera oblongifolia (Goldie) Hook.	2.9	-	11.6	-	.1	-	.2	-								
Lonicera villosa (Michx.) R.dS.													<.1	-	<.1	-
Prunus pensylvanica L.F.	11.4	10.9	101.3	94.8	13.3	12.4	139.4	126.9					.1	-	.9	.9
Prunus virginiana L.	2.4	-	12.0	-	7.2	-	37.2	-					.1	-	1.3	-
Salix bebbiana Sarg.													5.5	5.5	74.8	74.8
Salix L. spp.	10.9	-	83.2	-	70.9	47.7	790.4	595.7					2.5	2.3	20.9	20.1
Viburnum rafinesquianum Schult.													<.1	-	<.1	-
Stratum total	91.4		695.1		171.6		1,606.9		261.8		2,111.4		65.6		490.0	

(Table 16 continued on next page)

(Table 16.--continued)

	Isabella Plantations												BWCAW			
	11-15 n = 3				16-20 n = 3				21-25 n = 1				MATURE n = 19			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Low shrub																
Arctostaphylos Uva-ursi (L.) Spreng.											23.7				0.4	0.3
Chimaphila umbellata (L.) Bart.											9.6				.3	.1
Comptonia peregrina B.&B. Small. Rydb.															1.2	-
Diervilla Lonicera Mill.			45.6	23.5			58.1	31.5			48.2				17.0	8.9
Gaultheria hispidula (L.) Muhl.															.8	.4
Gaultheria procumbens L.			8.7	-			3.2	-			11.8				1.8	1.0
Juniperus communis L.															1.5	-
Ledum groenlandicum Oeder.															2.0	-
Ribes glandulosum Grauer.															<.1	-
Ribes lacustre (Pers.) Poir.															<.1	-
Ribes L. spp.			54.0	27.7			34.4	27.7			9.1				.6	-
Rosa acicularis Lindl.															1.8	.7
Rubus parviflorus Nutt.				.2			.6	.6			<.1				2.9	2.6
Rubus pubescens Raf.			100.7	66.0			102.3	81.3			.8				.8	.4
Rubus strigosus Michx.			4.8	4.5			12.7	7.9			35.9				23.8	17.9
Vaccinium angustifolium Ait.			17.4	11.2			1.1	-			1.9				26.4	17.3
Vaccinium myrtilloides Michx.			.2												4.7	2.9
Stratum total			231.4				212.4				141.1				86.1	
Herb																
Anaphalis margaritacea (L.) C.B. Clarke	<0.1	<0.1			<0.1	-							<0.1	-		
Anemone quinquefolia L.	<.1	-			<.1	-							.1	0.1		
Apocynum androsaemifolium L.	.8	.6			3.1	-							<.1	-		
Aquilegia canadensis L.					<.1	-										
Aralia nudicaulis L.	2.3	1.1			6.4	2.5			0.3				9.0	2.5		
Aster macrophyllus L.	92.4	14.9			86.0	29.0			8.3				36.4	13.0		
Carex L. spp.	<.1	-			<.1	-							.6	.3		

(Table 16 continued on next page)

(Table 16.--continued)

	Isabella Plantations												BWCAW			
	11-15 n = 3				16-20 n = 3				21-25 n = 1				MATURE n = 19			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE	$\bar{X}$	SE
Herb (cont.)																
Circaea alpina L.													0.1	-		
Clintonia borealis (Ait.) Raf.					2.9	2.3			6.9				4.2	1.4		
Coptis groenlandica (Oeder) Fern.													1.3	.6		
Cornus canadensis L.	2.5	-			7.9	-			26.9				21.8	5.7		
Epilobium angustifolium L.	1.0	0.9			.3	-							2.0	-		
Epigaea repens L.													.1	-		
Fragaria vesca L.					.6	-							.9	.5		
Fragaria virginiana Duchesne.	10.9	7.5											.7	.4		
Galium triflorum Michx.	.1	.1											.9	.8		
Goodyera repens (L.) R. Br.													.3	.1		
Goodyera tesselata Lodd.													.1	.1		
Grasses	141.6	49.0			77.8	55.0			18.4				12.4	5.2		
Habenaria Willd. SPD.													<.1	-		
Hepatica americana (D.C.) Ker.	<.1	-														
Lathyrus ochroleucus Hook.	41.9	16.4			2.4	-							.6	.5		
Lathyrus venosus Muhl.	8.9	4.8			23.7	-							.3	.2		
Lathyrus L. spp.	1.2	-														
Linnaea borealis L.	2.8	1.8											16.7	4.0		
Maianthemum canadense Desf.	.2	.1			6.1	4.3			8.3				7.2	1.4		
Melampyrum lineare Desr.					<.1	-							1.1	.5		
Mitella nuda L.													.4	.2		
Moneses uniflora (L.) Gray													<.1	-		
Petasites palmatus (Ait.) Gray													.3	-		
Polygala paucifolia Willd.	<.1	<.1			<.1	-							<.1	-		
Polygonum cilinode Michx.													.4	-		
Pyrola elliptica Nutt.													<.1	-		
Pyrola rotundifolia L.													<.1	-		
Pyrola secunda L.	2.1	1.1			.9	-							.1	.1		
Pyrola virens Schweigg.	.7	-							.1				.1	.1		
Solidago L. spp.	<.1	<.1														
Streptopus roseus Michx.					4.7	-							.3	.1		
Trientalis borealis Raf.	<.1	-											.3	.2		
Trillium cernuum L.													<.1	-		
Vicia americana Muhl.													.1	-		
Viola L. spp.	.4	-			.2	-							.4	.2		
Stratum total	309.9				223.1				69.2				119.2			

(Table 16 continued on next page)

(Table 16.--continued)

	Isabella Plantations												BWCAW			
	11-15 n = 3				16-20 n = 3				21-25 n = 1				MATURE n = 19			
	Foliage		Total		Foliage		Total		Foliage		Total		Foliage		Total	
	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE	$\overline{X}$	SE
Fern and fern allies																
Athyrium filix-femina (L.) Roth.													<0.1	-		
Dryopteris spinulosa (O.F. Muell.) Watt													.3	0.2		
Equisetum L. spp.													.1	-		
Gymnocarpium Dryopteris (L.) Newm.													.9	.6		
Lycopodium annotinum L.									<0.1				5.1	4.5		
Lycopodium clavatum L.	<0.1	-											2.4	1.1		
Lycopodium complanatum L.													.6	.4		
Lycopodium obscurum L.													1.8	1.0		
Polypodium virginianum L.													.1	-		
Pteridium aquilinum (L.) Kuhn.	288.1	61.8			82.9	42.4							11.5	6.8		
Stratum total	288.2				82.9				.1				22.9			
Moss																
Calliergonella schreberi (Willd., BR. & Sch.) Grout													1,310.0	182.9		
Dicranum Hedw. spp.													232.9	58.0		
Hylocomium splendens (Hedw.) B.S.G.													34.8	25.6		
Hypnum crista-castrensis Hedw.													26.1	10.0		
Polytrichum Hedw. spp.													46.4	20.5		
All other mosses													257.2	38.0		
Stratum total													1,907.4			
Lichen																
Cladonia mitis Sandst.													133.1	49.3		
Cladonia rangiferina (L.) Web.													52.1	27.2		
Cladonia sylvatica (L.) Hoffm.													.2	-		
Peltigera aphthosa (L.) Willd.													30.1	7.9		
All other lichens																
Stratum total													215.5			
Community total			25,027.9				62,782.4				54,781.8				141,313.2	

Table 17.--Aboveground ovendry biomass by species and stratum for the white-cedar community type of northeastern Minnesota

(In Kg/ha)

	BWCAW MATURE (n = 10)			
	Foliage		Total	
Stratum/species	$\bar{X}$	SE	$\bar{X}$	SE
Tree				
Abies balsamea (L.) Mill	2,863.5	736.2	22,121.0	5,776.6
Betula papyrifera Marsh.	3,756.8	389.5	73,613.1	7,074.5
Picea glauca (Moench) Voss.	707.4	220.0	7,038.8	2,273.8
Picea mariana (Mill.) B.S.P.	102.9	77.5	975.0	732.4
Pinus strobus L.	355.8	327.1	7,821.7	7,113.4
Populus tremuloides Michx.	325.8	283.6	17,961.8	15,940.9
Sorbus americana Marsh.	8.1	5.7	91.9	64.8
Thuja occidentalis L.	6,231.5	1,023.2	69,034.2	11,714.3
Stratum total	14,351.8		198,657.5	
Sapling				
Abies balsamea (L.) Mill.	665.1	318.5	5,616.6	2,677.3
Betula papyrifera Marsh.	52.4	27.8	1,875.1	974.2
Picea glauca (Moench) Voss.	2.2	1.6	14.9	11.2
Picea mariana (Mill.) B.S.P.	34.4	24.8	212.7	156.7
Pinus strobus L.	2.3	-	40.0	-
Populus tremuloides Michx.	18.1	-	455.9	-
Sorbus americana Marsh.	1.1	.5	11.6	4.8
Thuja occidentalis L.	822.0	337.9	3,964.5	1,640.3
Stratum total	1,597.6		12,191.3	
Tree seedling				
Abies balsamea (L.) Mill.	48.8	10.6	100.8	22.6
Betula papyrifera Marsh.	.7	.2	13.2	3.3
Fraxinus nigra Marsh.	.1	-	.3	-
Picea glauca (Moench) Voss.	2.3	.6	3.7	1.1
Picea mariana (Mill.) B.S.P.	1.8	1.4	3.1	2.5
Pinus strobus L.	.2	.1	1.2	.9
Populus tremuloides Michx.	.2	.2	1.1	-
Sorbus americana Marsh.	10.1	3.7	56.8	21.4
Thuja occidentalis L.	85.0	36.8	163.8	81.4
Stratum total	149.2		344.0	
Tall shrub				
Acer spicatum Lam.	206.9	45.3	2,166.0	573.1
Alnus crispa (Ait.) Pursh.	<.1	-	<.1	-
Amelanchier Medic. spp.	<.1	<.1	<.1	<.1
Cornus rugosa Lam.	<.1	-	.1	-
Corylus cornuta Marsh.	36.0	17.4	244.9	124.8
Lonicera canadensis Marsh.	2.1	.4	7.1	1.2
Lonicera villosa (Michx.) R.dS.	.1	-	.1	-
Prunus virginiana L.	<.1	<.1	<.1	<.1
Taxus canadensis Marsh.	12.8	8.8	23.2	16.0
Stratum total	258.0		2,441.5	

(Table 17 continued on next page)

(Table 17.-continued)

Stratum/species	BWCA MATURE (n = 10)			
	Foliage		Total	
	$\bar{X}$	SE	$\bar{X}$	SE
Low shrub				
Chimaphila umbellata (L.) Bart.			0.2	0.1
Diervilla Lonicera Mill.			2.5	2.2
Gaultheria hispidula (L.) Muhl.			.3	.2
Juniperus communis L.			.4	.3
Ribes americanum Mill.			<.1	-
Ribes glandulosum Grauer.			<.1	-
Ribes lacustre (Pers.) Poir.			<.1	-
Ribes triste Pall.			<.1	-
Rubus parviflorus Nutt.			11.4	6.6
Rubus pubescens Raf.			3.6	1.8
Rubus strigosus Michx.			.8	.7
Stratum total			19.3	
Herb				
Aralia nudicaulis L.	17.1	4.3		
Aster macrophyllus L.	10.7	3.5		
Carex L. spp.	7.6	3.7		
Circaea alpina L.	.6	.5		
Clematis viginiana L.	.1	-		
Clintonia borealis (Ait.) Raf.	9.3	2.2		
Coptis groenlandica (Oeder) Fern.	1.2	.4		
Cornus canadensis L.	11.3	2.3		
Galium triflorum Michx.	.7	.4		
Goodyera repens (L.) R. Br.	.3	.2		
Grasses	4.1	2.2		
Habenaria orbiculata (Pursh) Torr.	.5	-		
Impatiens capensis Meerb.	3.8	2.9		
Lathyrus ochroleucus Hook.	.2	-		
Linnaea borealis L.	6.1	3.2		
Maianthemum canadense Desf.	4.2	1.5		
Mertensia paniculata (Ait.) G. Don.	.7	-		
Mitella nuda L.	16.1	4.0		
Moneses uniflora (L.) Gray	.1	.1		
Oxalis montana Raf.	.5	.5		
Pyrola secunda L.	.6	.2		
Pyrola virens Schweigg.	.2	.2		
Streptopus roseus Michx.	2.7	1.6		
Trientalis borealis Raf.	2.1	1.1		
Viola L. spp.	1.8	.6		
Stratum total	102.6			
Fern and fern allies				
Athyrium filix-femina (L.) Roth.	0.7	-		
Botrychium virginianum (L.) Sw.	.6	-		
Cystopteris fragilis (L.) Bernh.	.1	-		
Dryopteris phegopteris L.	.1	-		
Dryopteris spinulosa (O.F. Muell.) Watt	11.0	4.7		
Gymnocarpium lryopteris (L.) Newm.	5.4	2.3		
Lycopodium annotinum L.	1.9	1.0		
Lycopodium clavatum L.	1.6	.8		
Lycopodium lucidulum Michx.	1.3	.8		
Lycopodium obscurum L.	1.9	1.6		
Stratum total	24.6			
Moss				
Calliergonella schreberi (Willd., BR. & Sch.) Grout	100.4	57.4		
Dicranum Hedw. spp.	8.5	4.7		
Hylocomium splendens (Hedw.) B.S.G.	44.3	19.5		
Hypnum crista-castrensis Hedw.	1.3	.5		
Polytrichum Hedw. spp.	5.4	4.3		
All other mosses	533.3	89.6		
Stratum total	693.2			
Lichen				
Cladonia rangiferina (L.) Web.	0.5	-		
All other lichens	16.9	7.7		
Stratum total	17.4			
Community total			214,491.4	

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Plant species biomass estimates for 13 upland community types of northeastern Minnesota. Resour. Bull. NC-88. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station; 1985. 52 p.

Presents total aboveground ovendry biomass estimates by stratum and species for 13 plant community types located in northeastern Minnesota.

KEY WORDS: Plantation, biomass estimation, dry weight, silviculture, plant community.

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